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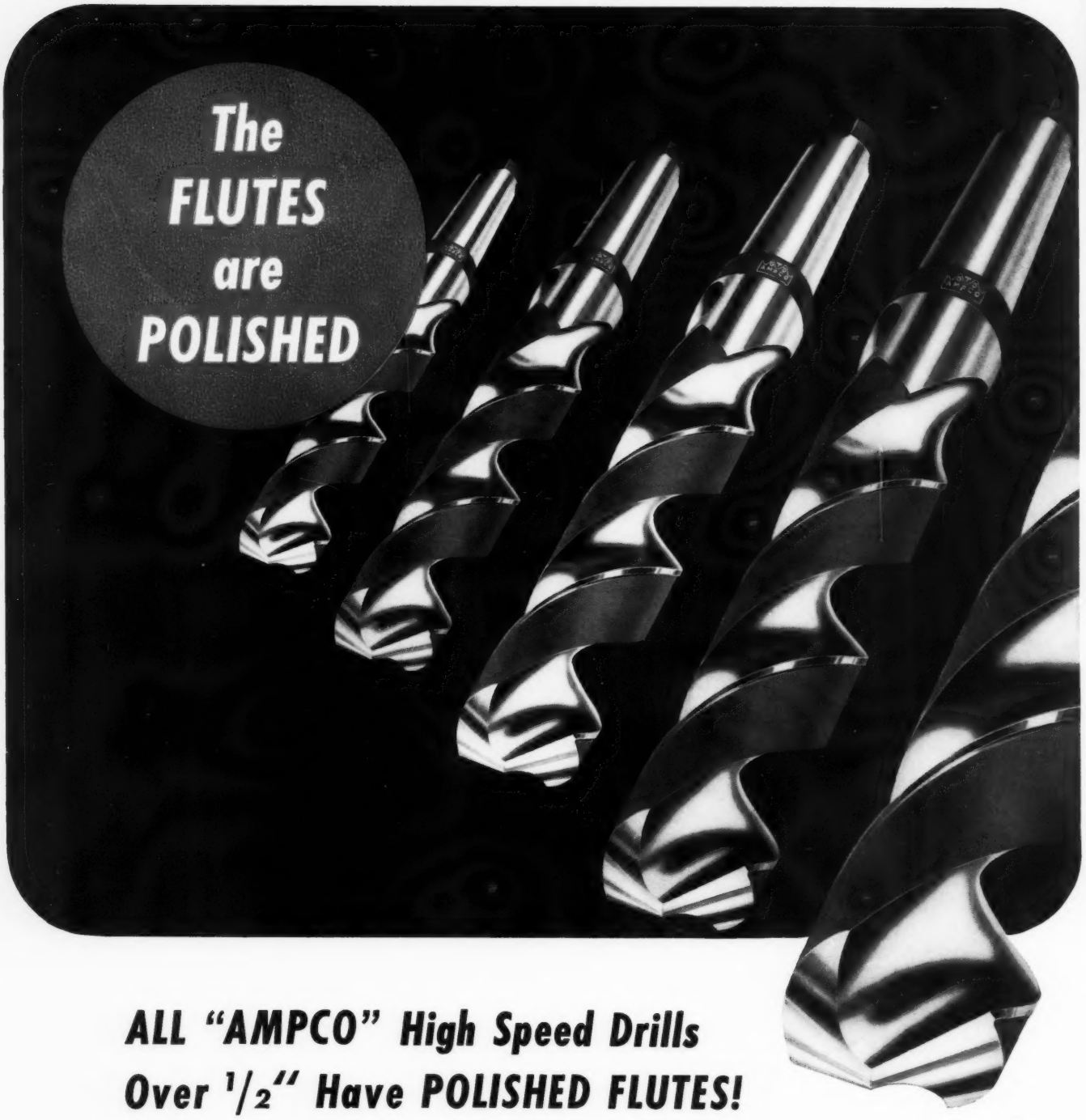

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FREEMAN C. DUSTON
HOLBROOK L. HORTON
CHARLES H. WICK
GEORGE H. DeGROAT

Consulting Editors
ERIK OBERG
FRANKLIN D. JONES

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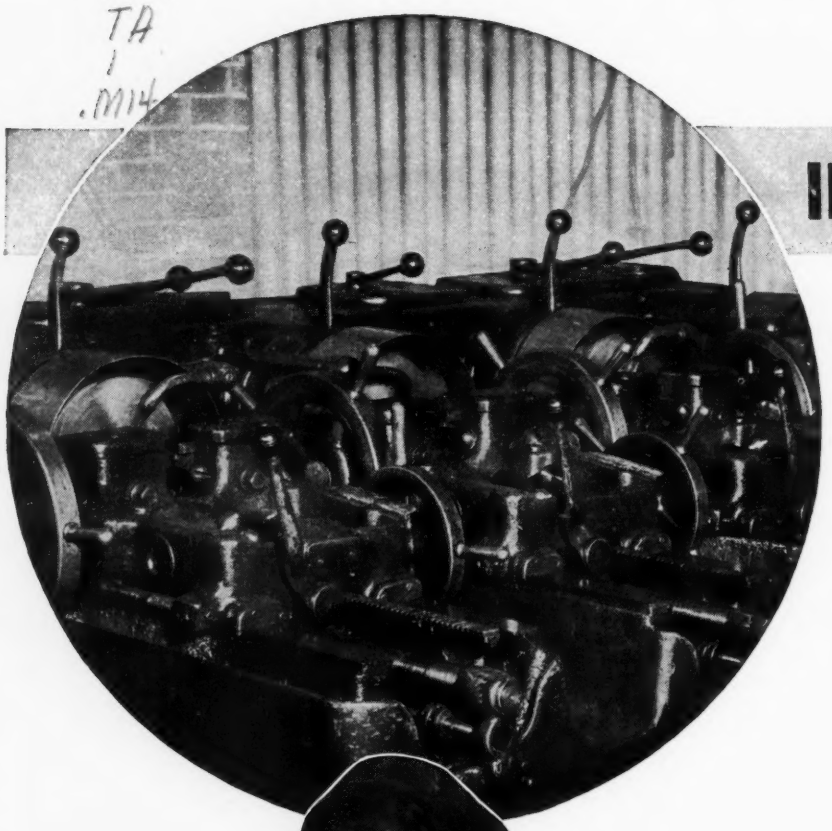

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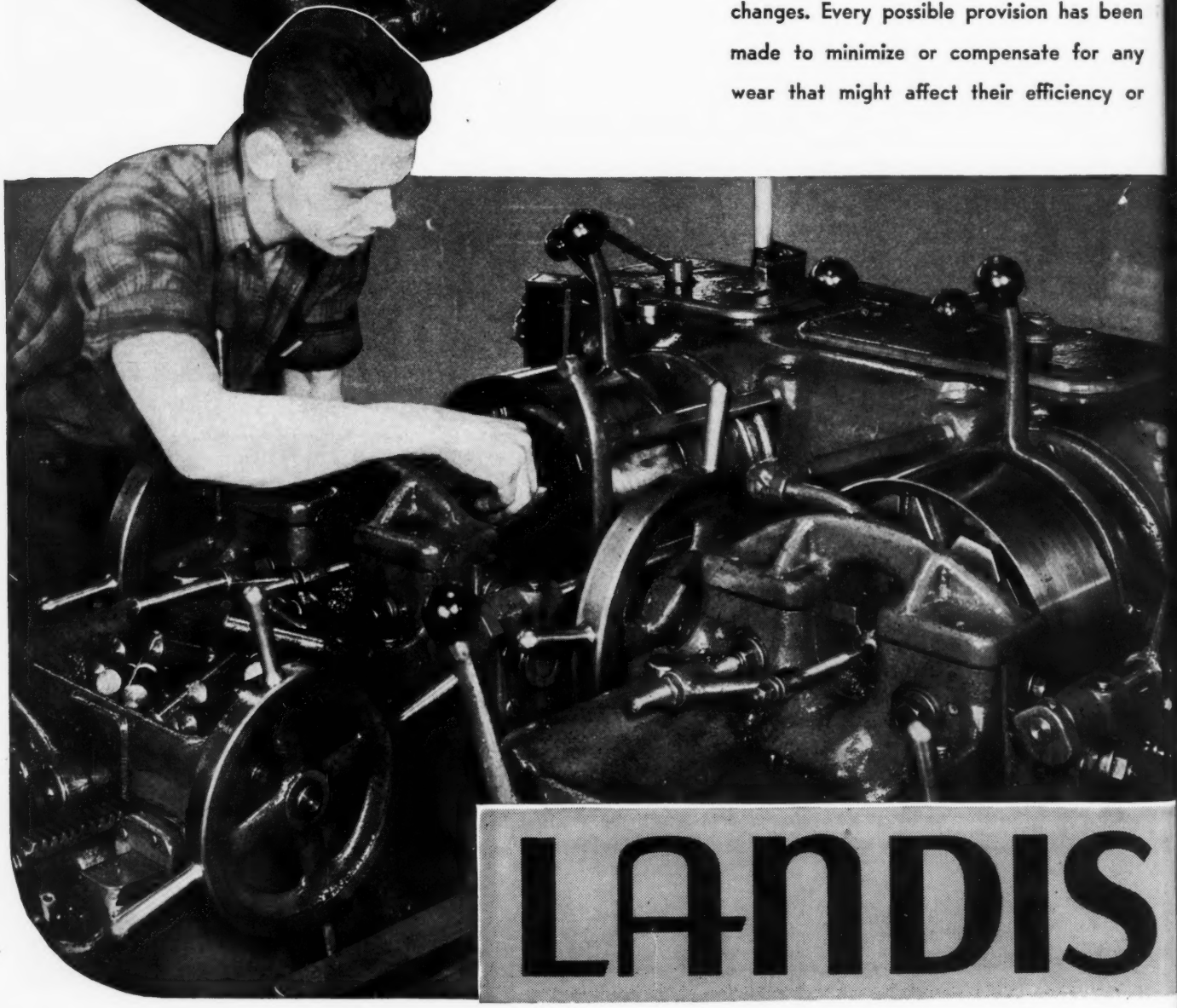

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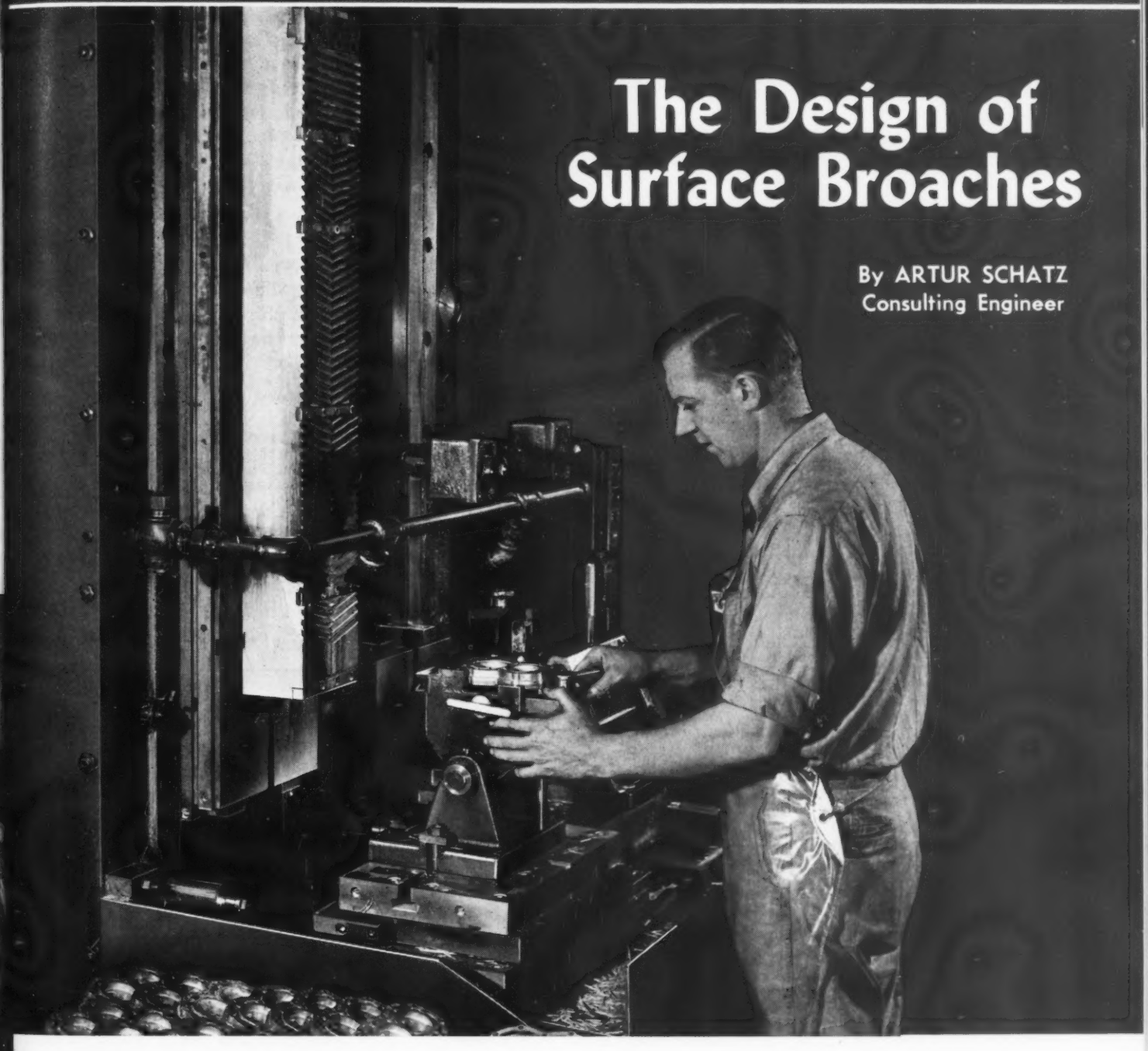


The Design of Surface Broaches

By ARTUR SCHATZ
Consulting Engineer

THE design of a surface broach is a problem that cannot be solved by mathematical means alone. There are, it is true, computable relations between certain elements of the tool, such as depth of cut per tooth, cutting length of broach, and pitch. However, the factors influencing the design of the broach that originate in the work, the machining operation, the broaching machine, and the method of tool manufacturing are so numerous and dissimilar that it is impossible to interconnect them mathematically. These factors are so complex that the determination of their effect on the basic characteristics of a broach requires considerable experience, as well as careful consideration of the problem. The relation between the work factors and the basic elements of the broach are indicated in Table 1.

The material of the work part is the feature that most influences the tooth profile and the

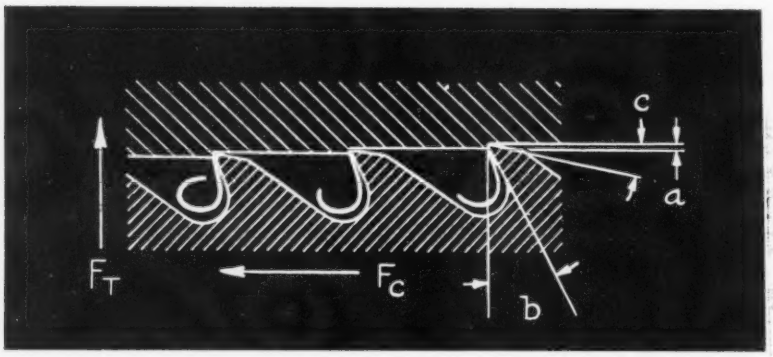


Fig. 1. Diagram Showing Broach Teeth in Cutting Contact with Work; "a" Indicates Depth of Cut per Tooth, "b" Front Angle of Teeth, and "c" Clearance Angle. The Thrust, which Acts in a Direction Perpendicular to the Surface Generated, is Indicated at F_T. The Major Cutting Force Acts in the Direction of the Tool Relative to the Work, as Shown at F_C

cutting length of the broach. It determines the depth of cut per tooth, the tooth cutting angles (see Fig. 1), the disposition and width of chip-breaker grooves (Fig. 2), and the dimensions and profile of chip space, thereby establishing the pitch. Table 2 indicates the proportions of chip space for different lengths of cut.

Cutting angles of broach teeth and dimensions of chip-breaker grooves for various materials are given in Table 3. The more ductile the material is, the wider the chip-breaker grooves have to be, and the smaller the distance between them must be. Table 4 gives the average depths of cut per tooth for different kinds of materials.

Table 1. Basic Broach Elements Affected by Work Factors

Work Factors	Type of Cutting Teeth	Cut per Tooth	Front Angle, Clearance Angle, and Chip-Breaker Grooves	Shear Angle	Allowable Pitch	Chip Space Min. Pitch	Length of Finishing Section	Cutting Length of Broach	Number of Broach Strokes	Broach Material
Material	..	X	X	..	X	X	..	X	X	X
Rigidity	X	X	..	X	X	..	X	X	X	..
Shape	X	..	..	..	..	..	..	..	..	..
Condition of Part prior to Broaching	X	..	..	..	..	..	..	X	..	..

When the material of the work part is particularly hard and tough, the broach material has to be of high-alloy high-speed steel, hardened to resist wear. Table 5 gives compositions and heat-treatments of suitable broach steels for various work materials.

Besides the material, the rigidity of the work part has an important influence on the design of a surface broach. The very heavy thrust F_T, shown diagrammatically in Fig. 1, that is developed by the broaching process demands special consideration when broaching work parts that are not sufficiently rigid and would have a tendency to yield under the cutting forces. To

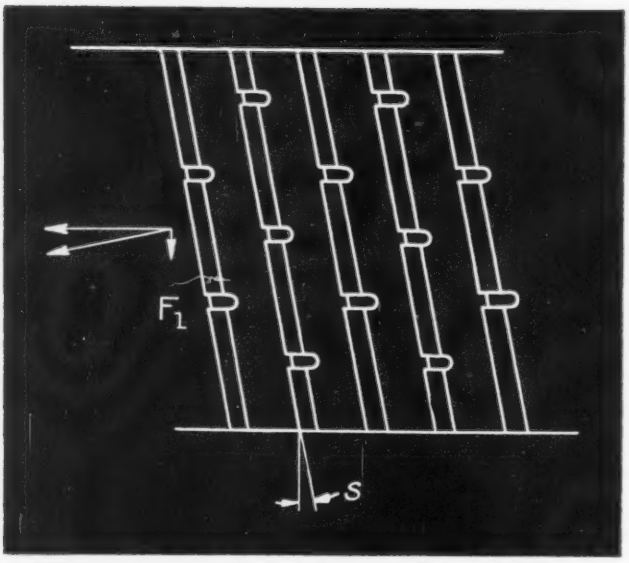
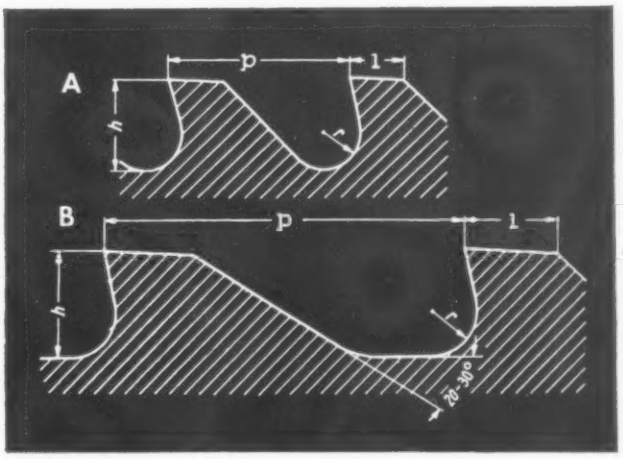


Fig. 2. Plan View of Broach Teeth Showing Chip-breaker Grooves and Shear Angle "s". The Lateral Force F_l Resulting from the Shear Angle of the Teeth is Shown Diagrammatically

avoid such yielding, the depth of cut per tooth is reduced as compared with that normally employed for a certain material. Another method of reducing the thrust is to increase the pitch of the broach teeth. Both means may increase the cutting length of the broach, and if the stroke of the machine is not sufficient, several cuts must be taken over the work.

Elastic materials, which yield to some extent under the cutting forces, must be permitted to spring back to their original form. This may be accomplished by providing an adequate length of the finishing part of the broach, where the cut per tooth is shallow and the thrust small. In broaching elastic materials, consideration must be given to the major cutting force (F_C, Fig. 1) acting in the direction of the motion of the tool relative to the work-piece (Table 6); the thrust F_T acting perpendicular to the surface generated; and the lateral force (F_l Fig. 2) that develops when using a shear angle and that acts in a direction perpendicular to the cutting force and parallel to the surface generated. In specially difficult cases, where an increased length of the finishing portion of the broach does not sufficiently reduce the elastic deformation of the work, the trouble may be overcome by the use of broaches designed on the side-cutting principle, as illustrated at *B*, Fig. 3, which changes the direction of the thrust.

Table 2. Proportions of Chip Space for Different Lengths of Cut



Proportions of Chip Space	Short and Medium Length Cuts (Diagram A)	Extremely Long Cut (Diagram B)
Depth of space h	0.4 × Pitch p	0.3 × p
Radius of space r	0.4 to 0.6 h	0.4 to 0.6 h
Land of tooth l	0.3 × p	0.25 × p

The shape of the work must be considered in determining the cutting principle. When the side-cutting method is used, there must be sufficient clearance at both sides of the section to

Table 3. Cutting Angles of Teeth and Dimensions of Chip-Breaker Grooves for Broaching Various Materials (See Figs. 1 and 2)

Material to be Broached	Face Angle, Degrees	Clearance Angle, Degrees		Dimensions of Chip-Breaker Grooves, Roughing Teeth Only†	
	Roughing and Finishing	Roughing	Finishing	Width, Inches	Depth, Inches
Steel, high tensile strength	10 to 12	1.5 to 3	0.5 to 1	0.02 to 0.08	0.02 to 0.04
Steel, medium tensile strength	14 to 18	1.5 to 3	0.5 to 1	0.02 to 0.08	0.02 to 0.04
Cast steel	10	1.5 to 3	0.5	0.02 to 0.08	0.02 to 0.04
Malleable iron	7	1.5 to 3	0.5	0.02 to 0.08	0.02 to 0.04
Cast iron, soft	10	1.5 to 3	0.5	0.02 to 0.08	0.02 to 0.04
Cast iron, hard	5	1.5 to 3	0.5	0.02 to 0.08	0.02 to 0.04
Zinc die-castings	12*	5	2	0.02 to 0.08	0.02 to 0.04
Cast bronze	8	0	0	0.02 to 0.08	0.02 to 0.04
Babbitt metal	2	Finishing Only	0 Straight Land 0.12 Inch Wide		
Aluminum die-castings	20*	5	2	0.02 to 0.08	0.02 to 0.04
Wrought aluminum alloy (copper-alloyed)	15*	3	1	0.02 to 0.08	0.02 to 0.04
Cast aluminum alloy (silicon-alloyed)	12*	3	1	0.02 to 0.08	0.02 to 0.04
Magnesium die-castings	20*	3	1	0.02 to 0.08	0.02 to 0.04

*Smooth surface finish of chip space recommended. †The distance between chip-breaker grooves may be 0.4 to 0.6 inch.

Table 4. Average Depths of Cut (in Inches) per Tooth for Various Materials (See dimension "a" in Fig. 1)

Material	Front-Cutting Broach		Side-Cutting Broach
	Roughing	Finishing	Roughing Only
Steel, high tensile strength	0.0012 to 0.002	0.0004	0.004
Steel, medium tensile strength	0.0024 to 0.004	0.0004	0.006
Cast steel	0.0024 to 0.004	0.0004	0.006
Malleable cast iron	0.0024 to 0.004	0.0004	0.008
Cast iron	0.004 to 0.010	0.0004	0.012 to 0.020
Brass	0.004 to 0.012	0.0004	Not Used
Zinc die-castings	0.004 to 0.010	0.0008	Not Used
Cast bronze	0.012 to 0.024	0.0004	Not Used
Wrought aluminum alloy (copper-alloyed)	0.004 to 0.008	0.0008	Not Used
Cast aluminum alloy (silicon-alloyed)	0.004 to 0.008	0.0008	Not Used
Magnesium die-castings	0.008 to 0.016	0.0008	Not Used

Note: Reduce values when broaching work parts with insufficient rigidity and close tolerances, and in cases where good surface finishes are required and the length of cut is short.

be broached to permit entering the first teeth of the broach into the work, as indicated at *A*, Fig. 4. In broaching a part with shoulders on the sides, clearance can be provided by the use of a wedge-shaped cutting section with front-cutting teeth, which must be arranged ahead of the side-cutting teeth, as shown at *B*, Fig. 4. Either a single wedge-shaped insert or several such inserts can be provided. In broaching curved surfaces containing convex radii, the teeth are so shaped and arranged that the operation gradually changes from front cutting to side cutting.

Consideration of the prior processing of the work part is another important factor in determining the method of cutting. The stock

Table 5. Composition of Steels Suitable for Surface Broaches and Their Heat-Treatment

Composition of Broach Steel*	For Broaching Materials Having a Tensile Strength Above 130,000 Pounds per Square Inch		For Broaching Materials Having a Tensile Strength Below 130,000 Pounds per Square Inch	
			Cross-Section of Broach Insert	
			Small	Large
Carbon, Per Cent	0.8	1.2 to 1.3	2.1	2.1
Chromium, Per Cent	4.0	4.0	12.0	12.0
Molybdenum, Per Cent	...	2.5	...	...
Tungsten, Per Cent	10.0	2.5	...	0.7
Vanadium, Per Cent	1.7	3.0	...	...
HEAT-TREATMENT				
Hardening Temperature, Degrees F.	2246 to 2300	1976 to 2048	1760	1760
Quenching Medium	Salt Bath of 932 to 1022 Deg. F. Oil Flowing Air	Flowing Air or Oil		
Tempering Heat, Degrees F.	1004 to 1040	1058 to 1076	356	356

*Broach steels of the composition given in the first two columns have high wear resistance, while steels of the composition given in the last two columns are distorted very little in heat-treating.

Table 6. Major Cutting Force Developed in Broaching Different Materials

Material to be Broached	Major Cutting Force (Thousand Pounds per Square Inch)							
	Side Cutting			Front Cutting				
	Depth of Cut per Tooth, Inch			Depth of Cut per Tooth, Inch				
	0.020	0.006	0.004	0.024	0.010	0.004	0.002	0.001
Steel, high tensile strength	...	...	400	..	...	...	500	625
Steel, medium tensile strength	...	285	...	..	...	315	370	485
Cast steel	...	230	...	..	...	255	315	...
Malleable iron	...	200	...	..	...	215	255	...
Cast iron	230	...	...	..	230	230	285	...
Cast brass	...	...	...	..	100	100	...	...
Brass, hot-pressed	...	...	...	..	170	170	...	...
Zinc die-castings	...	...	...	..	140	140	...	...
Cast bronze	...	...	...	70	70	...	...	...
Wrought aluminum alloy (copper-alloyed)	...	...	...	..	140	140	...	...
Cast aluminum alloy (silicon-alloyed)	...	...	...	..	170	170	...	...
Magnesium alloy	...	...	...	70	70	...	...	...

allowance for the machining of forged and cast work varies considerably, so that when the front-cutting method is used, it will be necessary to provide a certain number of teeth at the beginning of the cutting section of the broach that only cut from time to time when the stock is excessive, as shown at *A*, Fig. 5. Without these "safety" teeth, the first roughing tooth would have to cut irregular amounts of material, because of the varying stock allowance, and would very likely break under overload.

The additional teeth increase the cutting length of the broach and are likely to dull quickly, in various degrees, according to the frequency with which they strike the hard scale of the forged or cast work parts. Under such conditions, it is good practice to use side-cutting teeth, thereby removing nearly the full depth of the stock by narrow and relatively deep cuts, as indicated at *B*, Fig. 5. Thus the teeth remove equal amounts of stock, and variations in stock removal cannot reach dangerous amounts for a single tooth.

At the end of the regular cutting section some

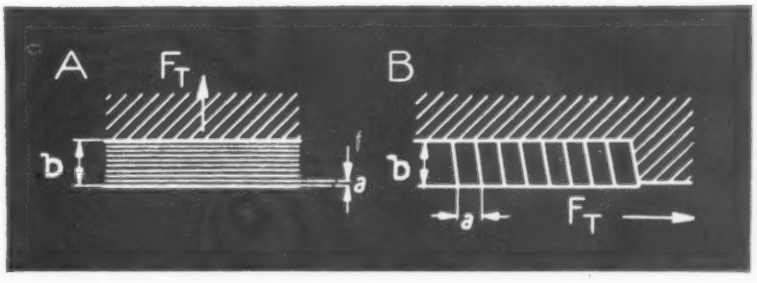


Fig. 3. Diagram Showing the Two Methods of Cutting in Surface Broaching and the Direction of Thrust F_T Resulting. (A) Stock Removed with Teeth on Top or Bottom Surface of Broach; (B) Stock Removed with Teeth at Side of Broach. Depth of Cut per Tooth is Indicated at "a" and Total Depth of Cut at "b"

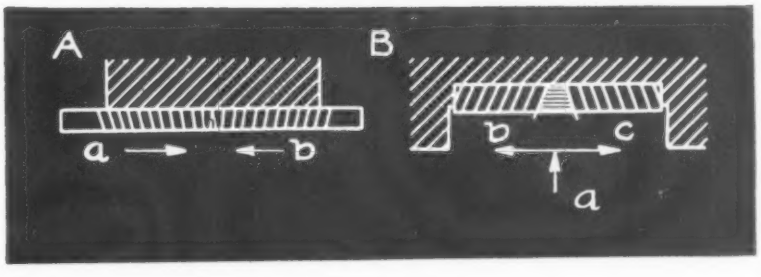


Fig. 4. (A) When the Work Shape Does Not Obstruct Entry of First Teeth of Broach, the Side-cutting Method May be Used. (B) When the Section to be Broached Does Not Permit Entry of First Teeth of Broach, Wedge-shaped Inserts with Front-cutting Teeth are Used Ahead of Side-cutting Teeth

Table 7. Work Factors to be Considered in Designing Broach Teeth

Work Factors	Arrangement of Broach Teeth		
	Front Cutting*	Side Cutting†	Wedge Type Cutting‡
Rigidity	Good	Yielding	Yielding
Shape	Without Influence	Free Approach to Sides of Section to be Broached	Approach to Sides of Work Impossible
Prior Processing	Machined Work Parts	Rough Castings and Forgings	
Surface Finish	Roughing and Finishing	Roughing Only	

*This arrangement is the one most generally used
†See View *B*, Fig. 3, and View *A*, Fig. 4
‡The wedge-shaped cutting section is arranged ahead of the side-cutting teeth. (See View *B*, Fig. 4.)

front-cutting teeth are added to size and improve the surface. The use of the side-cutting section, however, has the disadvantage of increasing the length of the broach and adding to the costs of manufacturing. Table 7 lists some of the factors that must be considered in deciding upon the type of broach teeth, or method of cutting. Different ways in which broaches are affected by the type of teeth are listed in Table 8.

Table 8. Effect of Tooth Arrangement on Other Factors in Broach Design

Tooth Arrangement	Manufacturing Costs	Cutting Force	Service Life	Length of Broach
Front Cutting	Lower	Heavy	Shorter	Short
Side Cutting	Higher	Small	Longer	Long
Wedge Type Cutting..	Higher	Small	Longer	Long

The machining operation, the broaching machine, and the methods of making the broaches are other important factors affecting the design of surface broaches. A discussion of these elements in connection with their influence on the basic characteristics of broaches will be given in the second installment of this article, to be published in a coming number of MACHINERY.

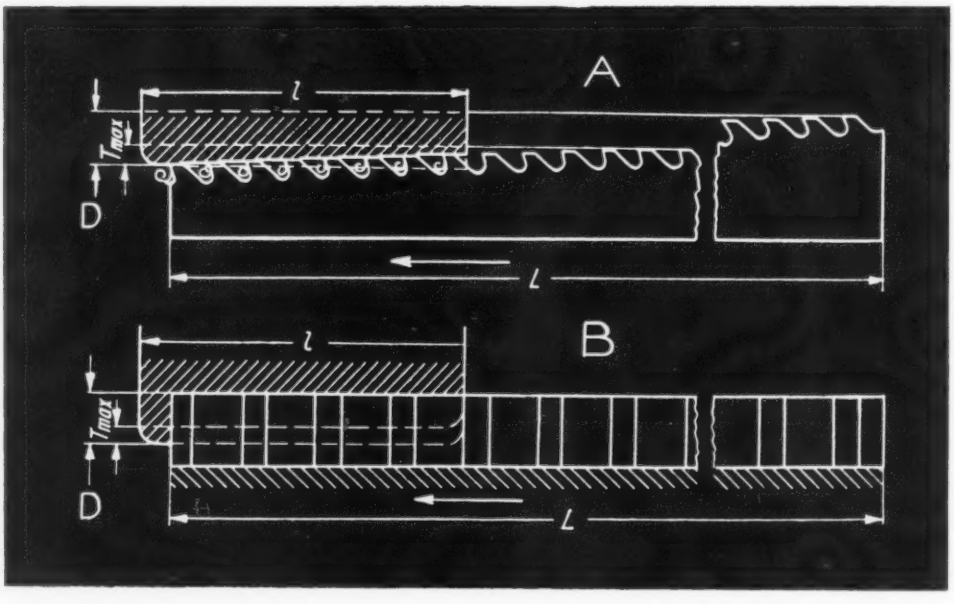


Fig. 5. Extra Teeth are Provided at the Beginning of the Cutting Section of Surface Broaches to Cut Occasionally when the Stock is Excessive, as in Cast and Forged Parts. The Arrangement for Front Cutting is Shown at A, and that for Side Cutting at B. "T" Represents Maximum Variation in Stock Allowance, "L" Cutting Length of the Broach, "l" Length of Cut, and "D" Depth of Stock to be Removed

Figuring Weights or Dimensions of Similar Shapes

By FRED B. MONEY
Superintendent Forge Shop and Plant Engineer
Baldt Anchor, Chain & Forge Co.
Chester, Pa.

IN the metal trades, particularly in forging and casting, it is frequently necessary to find the dimensions required to produce an article similar in shape to a part of known size and weight, but different in weight. Sometimes it may be necessary to determine the weight of a proposed article that is to be similar in shape to another part but of a different size.

Such problems may be solved by using the principle that the weights of similarly shaped solids vary as the cubes of the dimensions involved. For example, an article having all dimensions twice as large as another, but of similar shape, would weigh eight times as much. The figure eight is arrived at by multiplying two times two times two.

The following simplified rules have been developed to solve such problems with the least possible use of mathematics.

Rule 1—Given the size and weight of a sample article, to find the necessary dimensions of a proposed article of similar shape but with a different specified weight:

(A) Divide the specified weight of the proposed article by the known weight of the sample article.

(B) Extract the cube root (easily done on a suitable slide-rule).

(C) Multiply the cube root by any or all known dimensions of the sample to obtain corresponding dimensions of the proposed article.

Example—An anchor 109 inches long weighs 2600 pounds. A proposed anchor of similar shape is to weigh 10,000 pounds. How long must it be made?

According to Step (A) in Rule 1:

$$\frac{10{,}000}{2600} = 3.84$$

From Step (B),

$$\sqrt[3]{3.84} = 1.57$$

From Step (C),

$$109 \times 1.57 = 171 \text{ inches}$$

This is the necessary length of an anchor similar in shape to the sample but weighing 10,000 pounds. (All other dimensions of the proposed anchor are obtained by multiplying the corresponding dimensions of the sample article by the figure 1.57.)

Rule 2—Given the size and weight of a sample article, to find the weight of a proposed article of similar shape, but of a different specified size:

(A) Divide any specified dimension of the proposed article by the corresponding dimension of the sample article.

(B) Cube the result.

(C) Multiply the cube by the weight of the sample article to obtain the weight of the proposed article of similar shape but of different specified size.

Example—An anchor 109 inches long weighs 2600 pounds. A similar-shaped anchor is to be made 171 inches long. How much will it weigh?

From Step (A),

$$\frac{171}{109} = 1.57$$

From Step (B),

$$(1.57)^3 = 3.84$$

From Step (C),

$$3.84 \times 2600 = 10{,}000 \text{ pounds}$$

This is the weight of an anchor of similar shape but of different specified size.

Tempering in a

THE technique of using a steam atmosphere in heat-treating furnaces has recently been developed by the Leeds & Northrup Co., Philadelphia, Pa., to the point where the so-called "Steam Homo" method can be applied effectively in treating both ferrous and non-ferrous parts. In the case of non-ferrous materials, the steam atmosphere acts as an oxide-inhibiting agent, preventing discoloration and scaling during stress relief or other heat-treatment. When applied to steel and iron, the process becomes a special type of surface treatment, in addition to being a controlled-atmosphere tempering operation.

At a temperature of about 1050 degrees F., the surface of steel reacts with hot steam to form a thin skin of magnetic iron oxide about 0.0002 inch deep. This is the so-called "blue oxide" finish, which closely resembles a gun-metal finish. It is dense and hard, and has good resistance to corrosion.

To avoid the formation of oxides that cause scaling and rust, the new technique excludes all air from the furnace by a complete purge with steam. Because of the high temperatures employed, there is no possibility of steam condensing on the work and causing rust. As a further precaution, the furnace is designed to prevent leakage of air into the work chamber during the heat-treating cycle.

In heat-treating ferrous material, the work is loaded cold into the furnace, and then heated with a natural air atmosphere to about 700 degrees F. At this temperature, steam is admitted, and the furnace is held at this heat for a half hour. During this time, enough steam is introduced into the work chamber to provide about fifty furnace volume changes, thus removing all air from the work chamber. With steam still flowing continuously, the furnace is brought up to a temperature of 1050 to 1150 degrees F., and the work is soaked at this heat for the required time. The soaking time depends on the type of alloy being heat-treated and its use, generally ranging from thirty minutes to two hours. Many parts are quenched in soluble oil, but those requiring greater corrosion resistance may be air-cooled and dipped in oil at a lower temperature.

For non-ferrous work, a similar procedure is employed, but the temperatures are generally lower. In aging beryllium copper, the furnace is purged at about 400 degrees F. for a half hour, and then brought to the aging temperature. The parts are soaked for two to three hours, and then air-cooled or quenched in water. Stress relieving of brass parts follows the same technique—a half-hour purging at about 500 degrees F. and soaking for an hour at 800 to 1000 degrees F., usually followed by a water quench.

Small parts are generally loaded by simply dumping them into furnace work baskets. For example, bolts 5/16 inch in diameter by 1 inch long are dumped into the baskets in loads of 20,000 at a time. When they leave the steam-atmosphere furnace, the bolts have a uniform temper and color. Larger parts are loaded on trays or mounted on heat-treating fixtures.

Details of Equipment Used

The "Steam Homo" furnace is similar to other Leeds & Northrup electric furnaces employed for tempering and carburizing in that forced-convection heating is used. A motor-driven fan blows the furnace atmosphere up past spiral electrical heaters, and then pulls it down through the work chamber, thus giving rapid heating, a uniform soaking temperature, and thorough penetration of the steam throughout the load.

Steam Atmosphere

By HAL M. PARSHALL
Leeds & Northrup Co.

Longer Tool Life, Improved Machinability of Both Ferrous and Non-Ferrous Parts, and Increased Hardness of Powdered-Iron Parts are Some of the Advantages Obtained by Using Steam Atmospheres in Heat-Treating Furnaces

The cut-away view of this furnace seen in Fig. 2 illustrates the features incorporated to prevent air from leaking into the work chamber. Steam is introduced through an inlet at the bottom of the furnace and is exhausted to the outer atmosphere through a valve in the furnace lid.

"Steam Homo" furnaces are loaded vertically, and are usually installed in pits. Because of their compact design, they can often be placed directly in the production line to save routing of parts to and from a separate heat-treating department.

Steam for the furnace atmosphere can either be extracted from a process line or obtained from a small electric- or gas-fired boiler having a 1- to 3-H.P. rating, depending on the size of the furnace. The steam line should be suitably trapped. Steam entering the furnace should be at approximately atmospheric pressure and at a temperature of 212 degrees F. Inlet steam is maintained at the same pressure and temperature for all types of work.

Inside the furnace, the steam becomes superheated to the temperature of the furnace (about 1100 degrees F. for ferrous work). Steam pressure inside the furnace is regulated by the flapper valve through which the steam is exhausted, and is maintained at about 4 inches of water.

The atmosphere cost averages only a few cents per hundred pounds of product. Simply by leaving the steam valve closed, the furnace can be used for conventional tempering with natural air atmosphere at temperatures up to 1150 degrees F.

Furnace temperature is indicated by a thermocouple mounted in the lid and projecting into the work chamber, and is automatically regulated by a Micromax recording controller. Variations in supply voltage do not affect the furnace temperature because the control system inherently compensates for such fluctuations.

Tool Life Increased by Steam Heating

While steam treating is not a cure-all for every heat-treating problem, it has proved highly successful on many varied types of work. A few of the many parts treated in this way are seen in Fig. 3. In Leeds & Northrup's own shops, steam treatment of tools has proved its value so often that it is nearly always used when trouble is encountered on a cutting problem.

For example, one machining operation consisted of counterboring a 5/8-inch diameter hole drilled in a stainless-steel tube. New high-speed steel counterboring tools produced only two or

Fig. 1. Small Parts are Usually Loaded into Steam-atmosphere Furnaces by Simply Dumping Them into Work Baskets

three pieces before the cutting edge of the tool became deformed, even though ample cutting fluid was used. Three such counterbores were used before a steam-treated tool was tried. This tool completed the remainder of the order—some twenty-five pieces—and still showed satisfactory cutting surfaces at the end of the run.

Another type of material that often gives considerable trouble in machining is the heat-resistant alloy containing 35 per cent chromium and 15 per cent nickel. Hardness of this alloy varies considerably. One lot of parts made from this material could not be drilled at all; even when new drills were used, they dulled almost immediately. As a last resort, the tool was resharpened and then steam-treated, after which it was used to drill 200 pieces. This material is also hard to mill, and new milling cutters formerly lasted for only about twenty-five pieces. Steam-treated cutters, shown being loaded into a furnace in the heading illustration, now average about five times this amount.

Certain soft materials that present cutting problems can also be handled better with steam-treated tools. For example, screw machine forming tools often lose their edge quickly when cutting soft nickel stock because of the tendency of the cut metal to build up on the tool and overheat it. Steam treatment overcame this problem. Also, counterbores used on molded phenolic materials last several times as long as they used to before the adoption of steam tempering.

Outstanding results have been obtained with this process by most of the major manufacturers of twist drills. In cutting hard alloy steels, cast iron, or other abrasive materials, steam-treated drills have been found to outlast conventionally tempered drills by several hundred per cent. A manufacturer of broaching tools reports that steam treatment of large broaches—from 6 to 7 feet long—increased the service life three times. For some types of work, steam oxidizing of taps has been found to lengthen the tool life several times.

There are two principal reasons why steam treating increases tool life. First, the blue oxide coating, though hard, has microscopic pores that retain the cutting lubricant better than the base metal. Second, the coating also helps to prevent metal chips from adhering to the tool and causing friction that would result in overheating and dulling the cutting edge.

Machinability of Steel Parts Improved

When applied to steel parts other than high-speed steel tools, steam treatment often improves machinability. Cutting tools last longer without resharpening, and less time is lost in changing the tools. Finish-grinding of steam-treated parts is easier, too. Steam-oxidized parts do not load the grinding wheels as readily as air-drawn parts because their surfaces are much cleaner and have less scale, and the scale they do have is hard and uniform.

One user has found that steel aircraft studs made from S A E 3135 steel, which were formerly air-tempered and then cleaned by shot-blasting before final machining, can now be finish-ground directly after steam treatment, thereby eliminating one production operation. Moreover, with the previous heat-treatment, surface finish after grinding was about 15 micro-inches; with the new treatment, it averages 8 micro-inches.

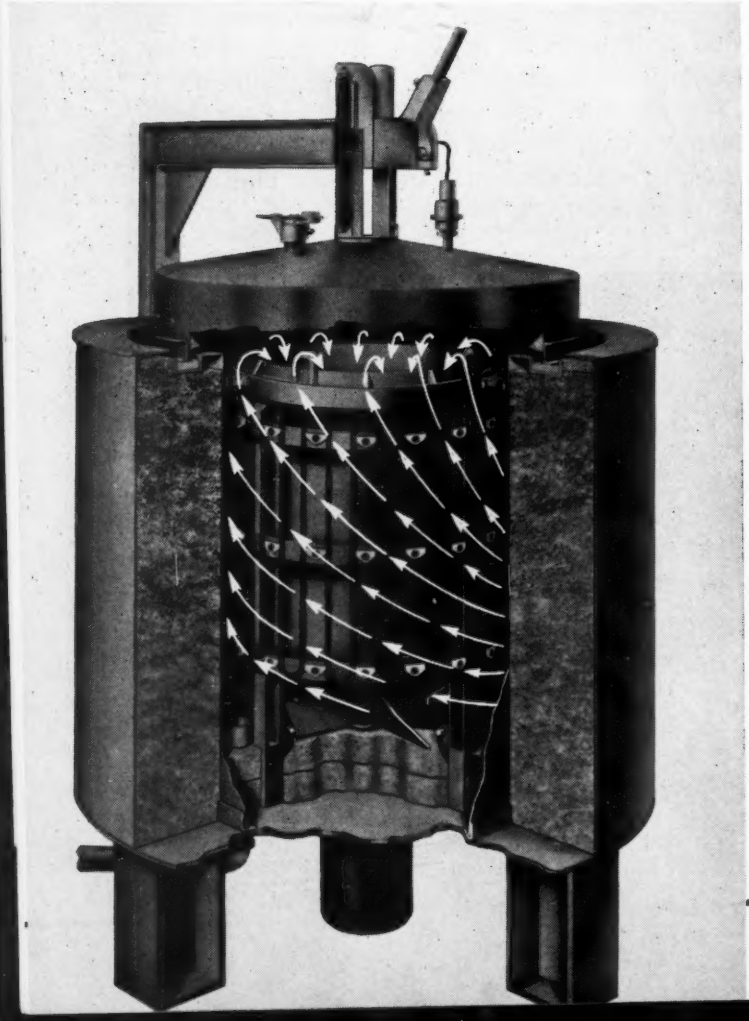


Fig. 2. Cut-away View of an Electrically Heated Furnace Employed for Tempering with a Steam Atmosphere. The Hot Steam is Circulated past the Heaters and Through the Work Chamber by a Fan

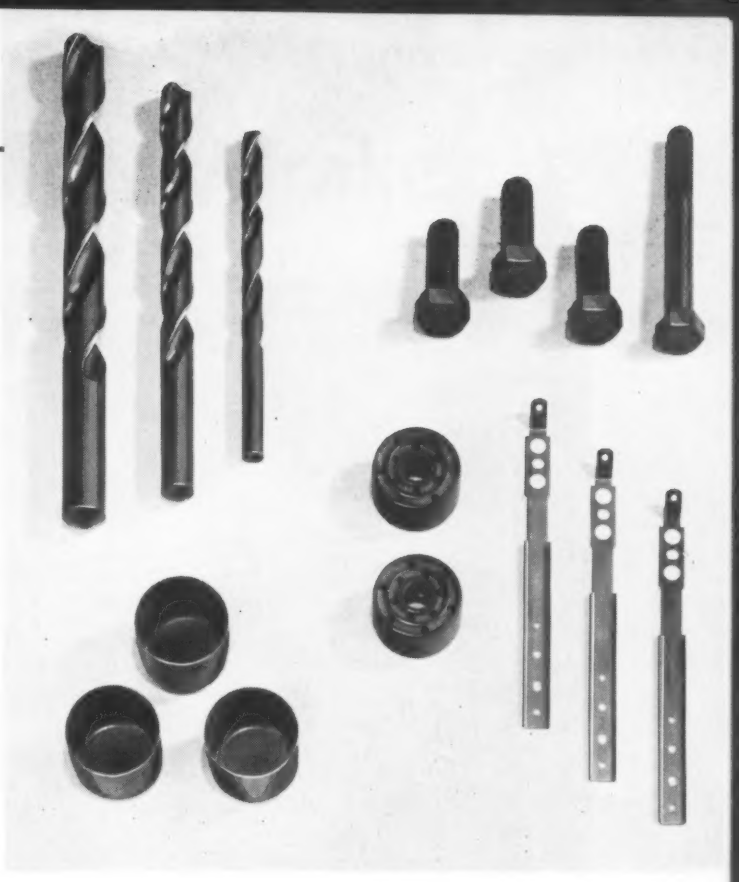


Fig. 3. A Few of the Many Parts that have been Successfully Treated in Steam-atmosphere Furnaces. Twist Drills, Steel Bolts, Brass Cups, Powdered-iron Pistons, and Beryllium-copper Parts are Shown

A prominent maker of high-speed steel tools resorts to steam treatment when machining troubles develop. In milling, "climb" or down milling is employed whenever possible, so that the cutting edge first contacts the steam-oxidized surface of the work. Here, too, the ability of the oxide coating to retain lubricant appears to be important in improving machinability.

A manufacturer of bearing shells found that the use of steam atmosphere instead of natural atmosphere for annealing lengthened the tool life in final machining. The shells, made of S A E 1015 steel, are formed, annealed, and then precision-bored and machined. The use of steam annealing tripled the tool life.

Scale Formation Reduced by Steam Atmosphere

The protective action of the steam atmosphere prevents scaling of both ferrous and non-ferrous parts during tempering and stress-relieving operations. The clean surfaces provided are particularly valuable when the parts are to be plated, since the amount of pickling required is often substantially reduced. Also, because the steam-oxidized coating has a controlled composition and is uniformly thin, the pickling time can be established accurately. Prolonged pickling, to make sure that the surfaces are clean, is no longer necessary. For example, a manufacturer of cadmium-plated aircraft bolts has found that steam-tempered bolts need only one-sixth as much time for pickling prior to plating as air-tempered bolts.

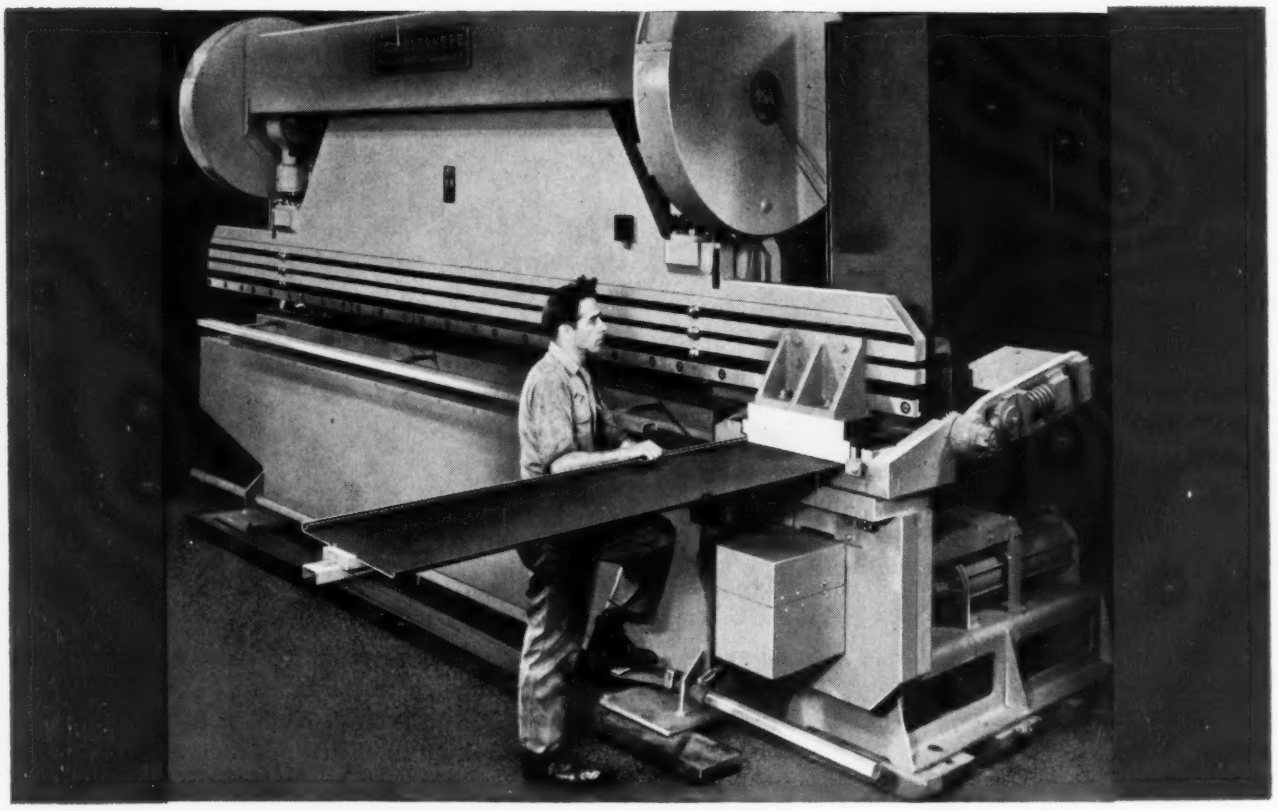
Stamped and deep-drawn parts made of brass or beryllium copper, such as bearing cups, spring parts for electrical switches, etc., are heat-treated with practically no scale by the new method. For this type of work, steam treatment has several advantages. Because the surfaces of the parts are clean, pickling to remove scale between cold-forming operations can often be eliminated. Also, as is the case with steel parts, brass and copper pieces that must be plated are considerably easier to clean.

A promising field for steam treatment is in the heat-treatment of powdered-iron parts. The most important effect of this treatment is a great increase in the hardness of the iron part. In some cases, this improvement in hardness has made it possible to utilize a powdered metal design for a part which might otherwise be too soft for the intended service. For example, one of the large automobile manufacturers applies steam treatment to powdered-iron shock-absorber pistons. These particular parts are cylindrical cups, about 1 inch in diameter by 3/4 inch long. They are loaded into work trays, steam-treated, and air-cooled.

Before treatment, the hardness of the pistons is between 15 and 20 Rockwell B. After treatment, it averages from 80 to 90 Rockwell B throughout the piece. This increase is due primarily to the fact that the hot steam combines with the iron surfaces, forming a hard blue oxide which partially fills the pores in the powdered structure. At the same time, the compressive strength of the powdered part is raised considerably.

Bearing surfaces of steam-treated, powdered-iron parts usually show improved resistance to wear. The oxide coating has good lubricant retaining qualities and moving parts "break in" to an excellent fit. As rapidly as the original surface is worn away, a new hard wear-resisting oxide surface is exposed. Corrosion resistance is also increased, especially if the part is subjected to periodic heating and cooling, which would cause condensation.

Metal Cabinets Formed



The Versatility of the Press Brake has been Increased by the Use of a Tangent Bending Attachment, which Permits Metal Cabinets to be Completely Formed on One Machine. This New Method is Especially Suitable for Production Runs up to 200 Cabinets a Day per Machine

By CHARLES H. WICK

BENDING of flanged metal sheets to form cabinets for refrigerators, washing machines, vending machines, and similar equipment is a troublesome operation because of the fact that the flange metal tends to wrinkle at the rounded corners of the cabinet. When high production warrants the cost of tangent bending machines, this trouble can be eliminated. The only other alternative in the past has been to notch the flanges before bending, weld the notched flange after bending, and then grind the weld.

Now, however, limited production runs up to, say, 200 cabinets a day can be made on a single press brake without notching the flanges. By extending the bed and ram beyond the ends of the press brake and installing a tangent bending attachment, developed by the Cyril Bath Co., of Cleveland, Ohio, the versatility of the press brake has been increased to permit the complete forming of metal cabinets without wrinkling.

The outer shell and inner liner for a refrigerator, shown in Fig. 1, are produced at the rate of 180 per day on a press brake equipped with conventional flanging dies and a tangent bending attachment. Flat blanks of 18-gage (0.0478 inch thick) cold-rolled steel are employed. One edge of the blank is bent to an angle of 90 de-

Completely on a Press Brake

grees in a standard V-die, as seen in Fig. 2 and at *A* in Fig. 3.

Sharp bending and flattening of the same edge is accomplished by substituting the die shown at *B* and *C* in Fig. 3 for the V-die. Another die *D* is then employed to complete a triple lock flange on this edge of the part. The same die is employed to flange the other edge of the work, as seen at *E*, by substituting the insert shown at *X* for that shown at *Y*. The second flange is bent to an included angle of slightly less than 90 degrees in order to allow for springback after the bending operation.

After flanging a number of parts, the tangent bending attachment, mounted on the right-hand end of the press, as seen in the heading illustration, is employed. Separate controls are provided for the attachment, so that it can be operated independently of the press brake. The upper die *A* of the tangent bending attachment, Fig. 4, is bolted to the extended ram *B* on the press brake, while the lower die *C* is held on extended bed *D*. With the ram in its upper position, the flanged sheet-metal blank is slid between the upper and lower dies. The blank is located from its outer end by a gage provided on a channel-iron arm extending from the front of the attachment. The ram is then lowered by

Fig. 1. Outer Shell and Inner Liner for a Refrigerator. Both Parts are Flanged and Formed on a Press Brake at the Rate of 180 per Day

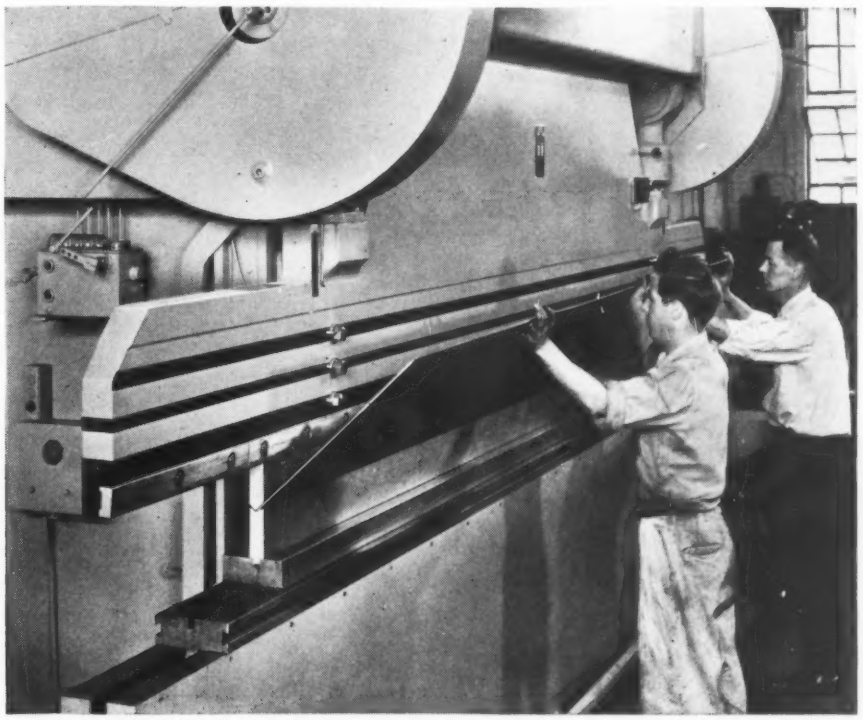


Fig. 2. Edges of the Sheet-metal Blanks are Flanged in Five Operations, Employing Three Pairs of Conventional Press Brake Dies

operating a foot-pedal, to clamp the work between the dies, as seen in the heading illustration. Lower die *C* is provided with a spring-actuated pad, so that the work is clamped before the ram reaches the bottom of its stroke. The press brake is equipped with an overload protection device which instantly releases the automatic clutch and disengages the flywheel in case of overloading.

A guided flat "wing" or shoe *E*, Fig. 4, which is held in a horizontal position for loading and unloading, is swung through an angle of 90 degrees to the vertical position shown by means of a rack and gear and linkage connected to the piston-rod of air cylinder *F*. The flat wiping surface of the wing remains tangent with the metal being formed while the part is progressively bent to conform with the contour on the lower rear corner of die *A*. Rounded corners with a 3 1/2-inch radius are formed in the example shown.

A large roller *G* contacts the rear surface of wing *E*, keeping the wing in contact with the metal being formed by the action of heavy railroad-car springs *H*. The tension of the springs is adjustable. The roller moves progressively upward on the wing as the wing assumes its vertical position, so that pressure is constantly exerted on the wing in line with that portion of the metal being formed.

Since the metal being formed is confined between the upper and lower dies and the wing, buckling is avoided and any wrinkles formed during bending are ironed out. The finished

Fig. 3. Progressive Steps in Forming a Triple Flange along One Edge of the Sheet-metal Blank and a Single Flange on the Opposite Edge

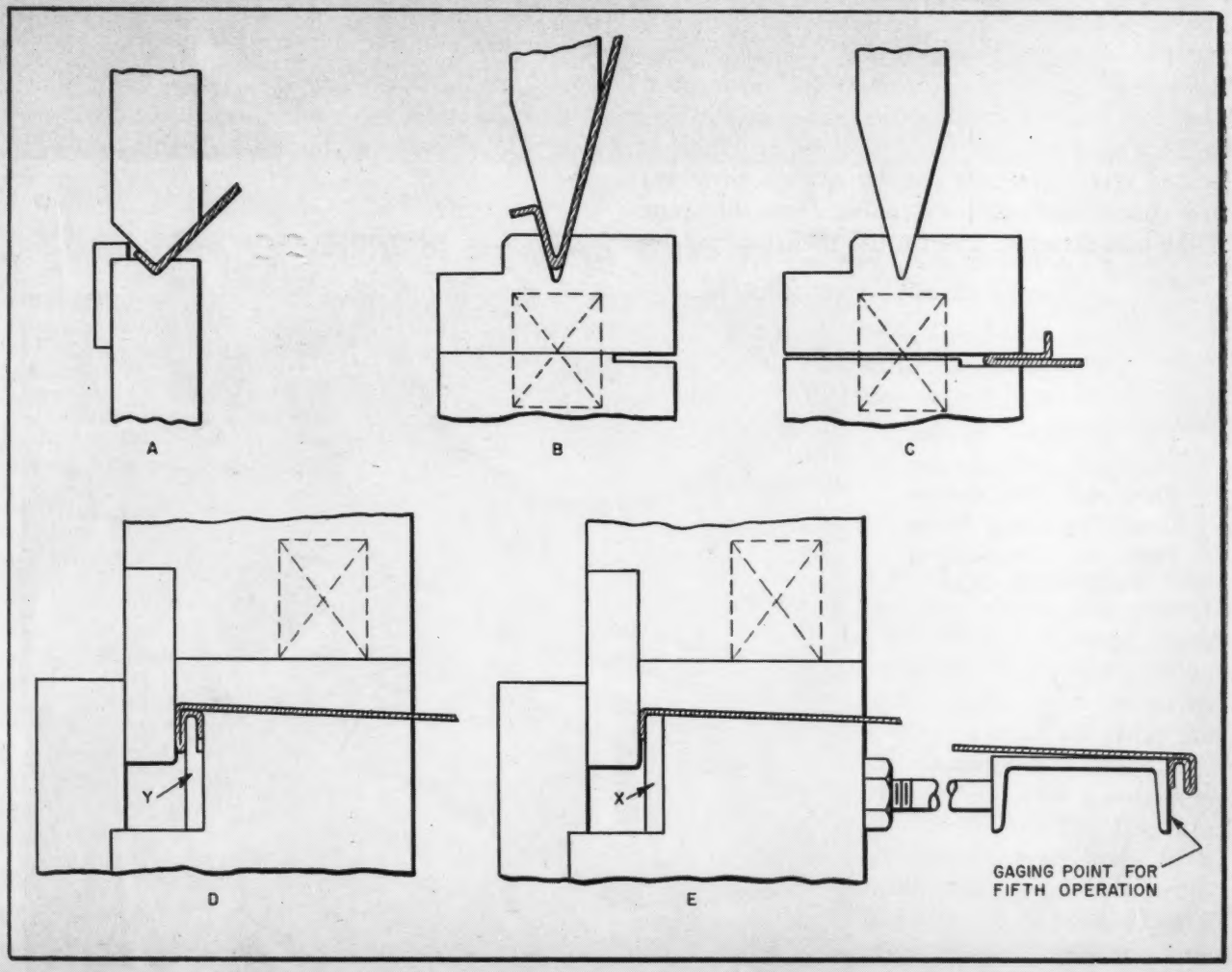


Fig. 4. Tangent Bending Attachment. Upper Die A is Bolted to Extended Ram B, while Lower Die C is Held on Bed D of the Press Brake

cabinet has a smooth, planished appearance both on the flanges and the curved corners composing the crown of the refrigerator. Finishing costs are thus minimized.

After forming one corner of the cabinet, the blank is advanced through the die to make the second bend. The wing is then returned to its horizontal starting position, as illustrated in Fig. 5, after which the completed part is unloaded from the rear of the tangent bending attachment.

This method has been applied in forming cabinets from both hot- and cold-rolled steel in 16-, 18-, and 20-gage thicknesses. Materials thinner than 20 gage (0.0359 inch) should not be formed in this way, since there will be a tendency for the sheets to tear. An adjustable spacer can be provided on the upper die to

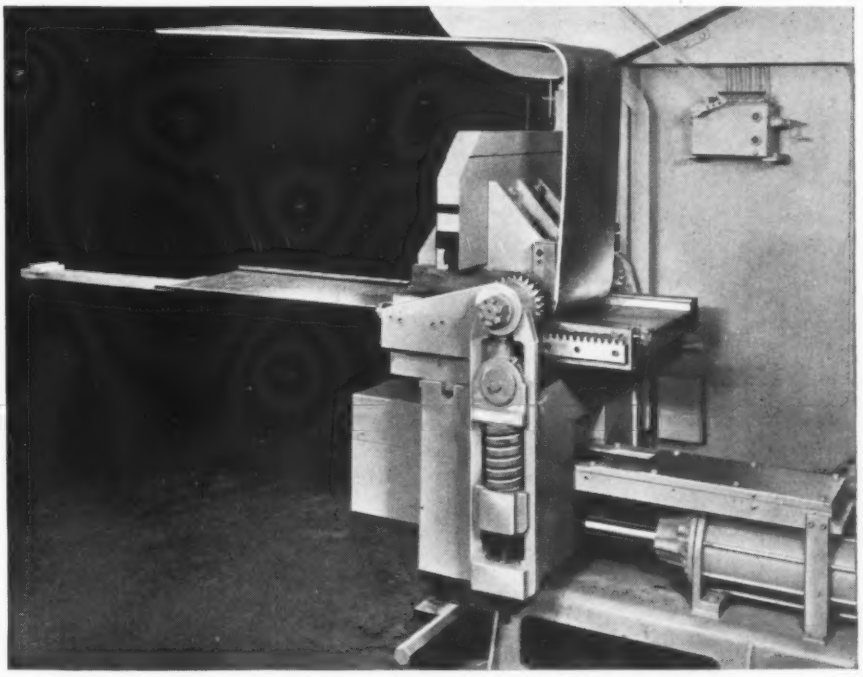


Fig. 5. The Completely Formed Cabinet is Now Ready to be Removed from the Tangent Bending Attachment. The Rack and Gear Actuated Wing has Returned to a Horizontal Position

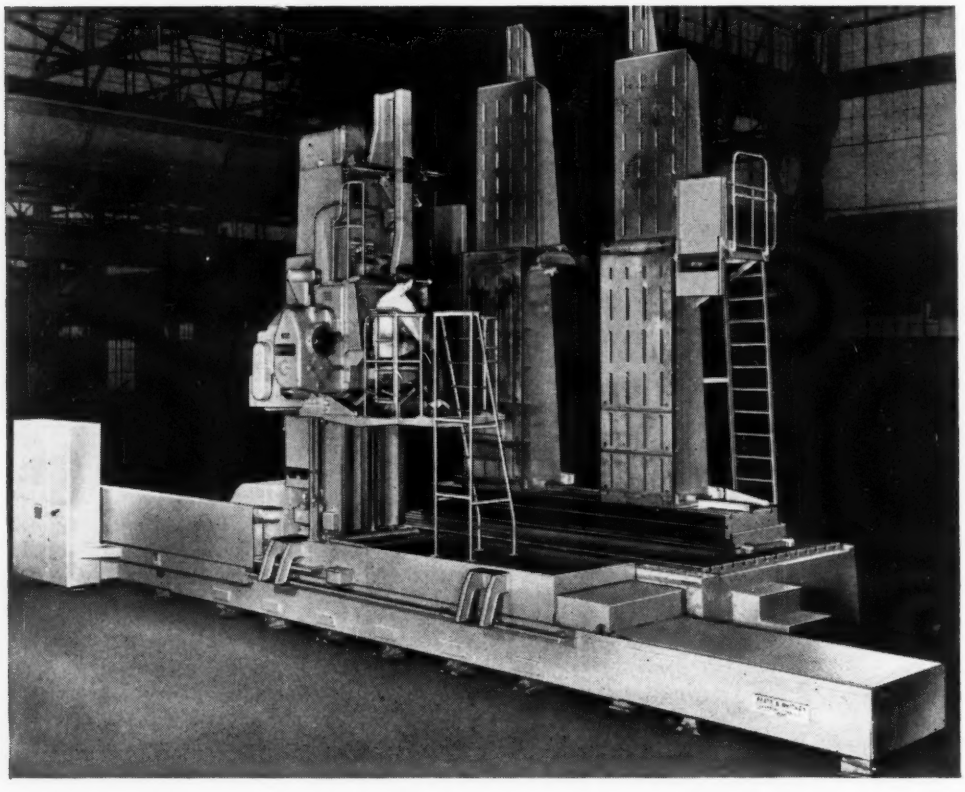
handle various thicknesses of metal in the same set-up.

In this method of forming, the flanges are compressed with relatively little stretching in the body of the sheet. In general, to obtain an unwrinkled flange by this method, the flanges should not be deeper than one-third the radius. For example, a 1-inch flange can be formed to a corner having a 3-inch radius without wrinkling. Where the edge of the blank is of the triple-flange type, however, as is the case in the example described, the flange depth may have to be reduced to 7/8 or 3/4 inch or the corner radius increased. In forming sharper corners, stress marks may appear on adjacent areas of the sheet. The tangent bending attachment is also limited to the forming of corners with radii of 1 to 5 inches, but tangent bending equipment is available for making bends up to a radius of 12 inches.

Higher production can be obtained by installing a tangent bending attachment at both ends of the press brake. However, it is generally preferable to employ a special-purpose machine, such as a single- or double-wing tangent bender, when production requirements exceed about 200 cabinets a day per machine. Production rates up to 2 to 3 cabinets a minute can be obtained by the use of specialized machines.

Tooling for the tangent bending attachment is relatively inexpensive. A soft, cut steel gear and rack can be employed. Ampco copper-base alloy is used for the wiping surface of the wing and those portions of the die that are subject to wear. It is necessary to change the gear and upper die to suit the radius desired on the part. The lower die, wing, and rack need not be changed. The air cylinder operates from ordinary shop pressure of about 70 pounds per square inch, and its stroke is adjustable up to 30 inches.

Since the elastic limit of the material is seldom reached by the stresses set up in this type of forming, allowance must generally be made in the dies for spring-back of the material after forming. The exact amount of spring-back can only be determined by experimentation. Since low-cost dies are employed in this method, however, the dies can be reworked after forming a few parts. In general, the normal spring-back that occurs in forming cold-rolled steel amounts to approximately 5 per cent.



Largest Keller Machine ever Built, which was Recently Completed by Pratt & Whitney at West Hartford, Conn. This Keller BG 22 Machine is Capable of Handling a Die 14 Feet Long by 7 Feet Wide. It Opens New Manufacturing Possibilities in Automotive and Other Shops where the Work Requires the Use of Large-sized Dies

Diplomacy Needed to Maintain Harmonious Industrial Relations

THE present year may well be a difficult one from the industrial relations standpoint. Labor, with a sympathetic national administration behind it, is certain to make the most of its opportunities to obtain favorable legislation for its cause. Harmonious industrial relations will depend upon wise use of the greater power that may come into the hands of the labor leaders and upon earnest collaboration on the part of management in the solution of controversies.

One of the obstacles to industrial harmony is the great amount of propaganda employed to sway opinion. It is only necessary to cite the biased oratory and published statements directed against the Taft-Hartley Act ever since its enactment. Too often protagonists of both labor and management viewpoints do not back up their statements with convincing proof, and this failure adds fuel to controversial issues. In the case of the Taft-Hartley regulations, even the Secretary of Labor had difficulty in attempting to show how its various provisions were detrimental to workers. On the other hand, labor looks with suspicion upon much of the publicity issued by various business associations—statements also made without convincing proof in some cases.

The time has come for both labor and management to approach their problems with an honest intent for a fair solution. Businessmen should lay their cards on the table in discussing matters that directly affect the workers and should be more frank in talking about earnings, dividends, capital depreciation, and other financial problems. It would be to management's advantage to explain the reasons for increased depreciation allowances and for using earned surpluses in plant improvement; by so doing, both labor and the public would be given a better understanding of the problems of management. To avoid erroneous conclusions, financial statements of both labor unions and corporations should give earnings after taxes have been deducted.

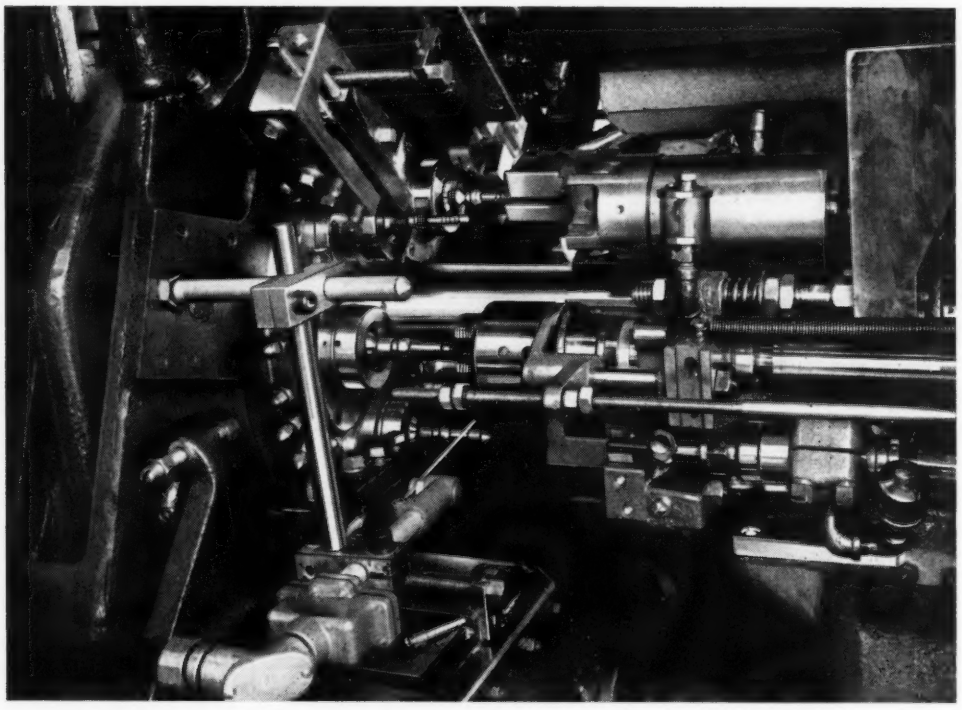
The General Electric Co. has taken a wise step toward the improvement of industrial relations by conducting research to determine what the employes like and dislike about their jobs and what they know and do not know about the problems of management. Based on the results of this research, the company has instituted a program of improving employes' jobs and of educating them concerning the economics of the company. Present faults and past mistakes of business in general, and of the General Electric Co. in particular, are honestly admitted.

Reduced to simple language, the objectives of labor and management are not so very far apart. Workers want economic security for their families, and managements want economic security for their business enterprises. There can be no security for workers unless business is prosperous, and business cannot be prosperous unless workers have the money to buy the products of industry. This year particularly, with buyers' markets again returning, both labor and management should exert the utmost diplomacy in solving their mutual problems.

Charles O. Herb

EDITOR

Producing Square Holes on Multiple-Spindle Automatics



ONE of the unusual operations performed in producing brass magnet shafts such as shown in Fig. 1 on a multiple-spindle automatic consists of rolling the outside diameter to produce a square hole in the stem of the part. Several ingenious tooling set-ups are employed for this and other operations on a National Acme six-spindle automatic bar machine. By the use of this equipment, a part is completely finished in a five-second cycle, giving a production of 720 magnet shafts per hour.

At the first station of the machine, as shown diagrammatically in Fig. 2, round brass rod, 9/16 inch in diameter, is fed to length against a stop. Then a circular form tool having a feed of 0.0027 inch per revolution turns four different diameters on the part. The speed of all six spindles on the machine is 2360 R.P.M. A drill, 21/64 inch in diameter, is employed to spot the end of the part. To minimize deflection of the work during forming, it is supported near its outer end by a roller.

After indexing to the second station, the stem or right-hand end of the magnet shaft is undercut and turned to the correct diameter for subsequent rolling to form a square hole; the large-diameter end of the shaft is faced; and the stem of the part is drilled to a diameter of 0.166 inch. A roller is again employed to steady the part during turning. The tools are fed at the rate of 0.0014 inch per revolution.

Ground-thread circular chasers mounted on

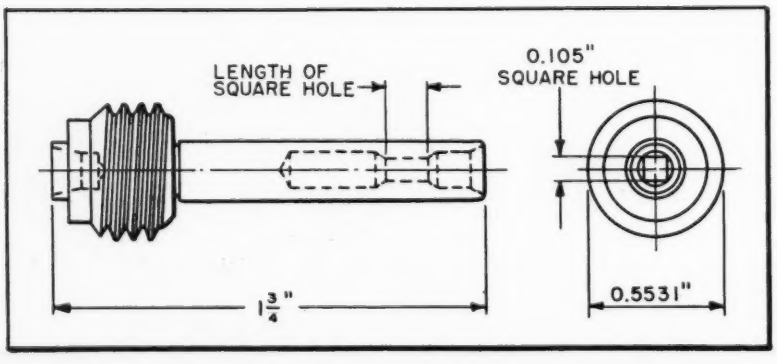


Fig. 1. Brass Magnet Shaft Produced in Fifteen Operations, Including the Forming of a Square Hole, on the Six-spindle Automatic Seen in the Heading Illustration

National Acme "Vers-O-Tool" heads are employed at the third station for producing a thread 0.553 inch in diameter with sixteen threads per inch. When the chasers have been sharpened, they are set by a micrometer gage, so that the cutting edges will be in the proper position to cut the thread to specifications.

The stem of the magnet shaft is squeezed between four rolls at the fourth station to form a portion of the hole in the stem to a square shape. For performing this operation, a square mandrel is placed in the hole. The rolling unit, including the four rolls and mandrel, is rotated at the same number of revolutions per minute and in the same direction as the piece. About one-third the length of the drilled hole is thus reduced from 0.166 inch in diameter to 0.105 inch square. At the same station, the small diameter at the left-hand end of the shaft is turned by means of a flat form tool.

At the fifth station, the stem end of the part is countersunk and chamfered by the use of an accelerated reaming attachment in which a two-step flat drill is used. The stem is also finish-turned and the small diameter at the left-hand end of the shaft is shaved at this station. The part is cut off at the sixth station, after which a cam-operated pick-up attachment with swinging arm transfers it to an independently driven unit for counterboring the left-hand end of the shaft. The completed part is then ejected.

* * *

National Drive for Heavy Scrap

Wholehearted industrial participation in the national drive now under way for iron and steel heavy scrap has been requested by Secretary of Commerce Charles Sawyer. He has suggested that management in every plant appoint one top official to act as salvage director, with full responsibility for investigating heavy scrap possibilities in the plant and with authority to sell any unneeded iron and steel equipment, such as obsolete machinery, tools, and fixtures. The Secretary pointed out that it is necessary to build up scrap reserves in order to be able to meet any emergency demands and to insure full steel production.

* * *

An unusual method of making iron nuts is in use in a European plant. Powdered iron is compacted around a threaded insert which, when unscrewed, forms the threads in the nut. The nut is then sintered in accordance with common practice.

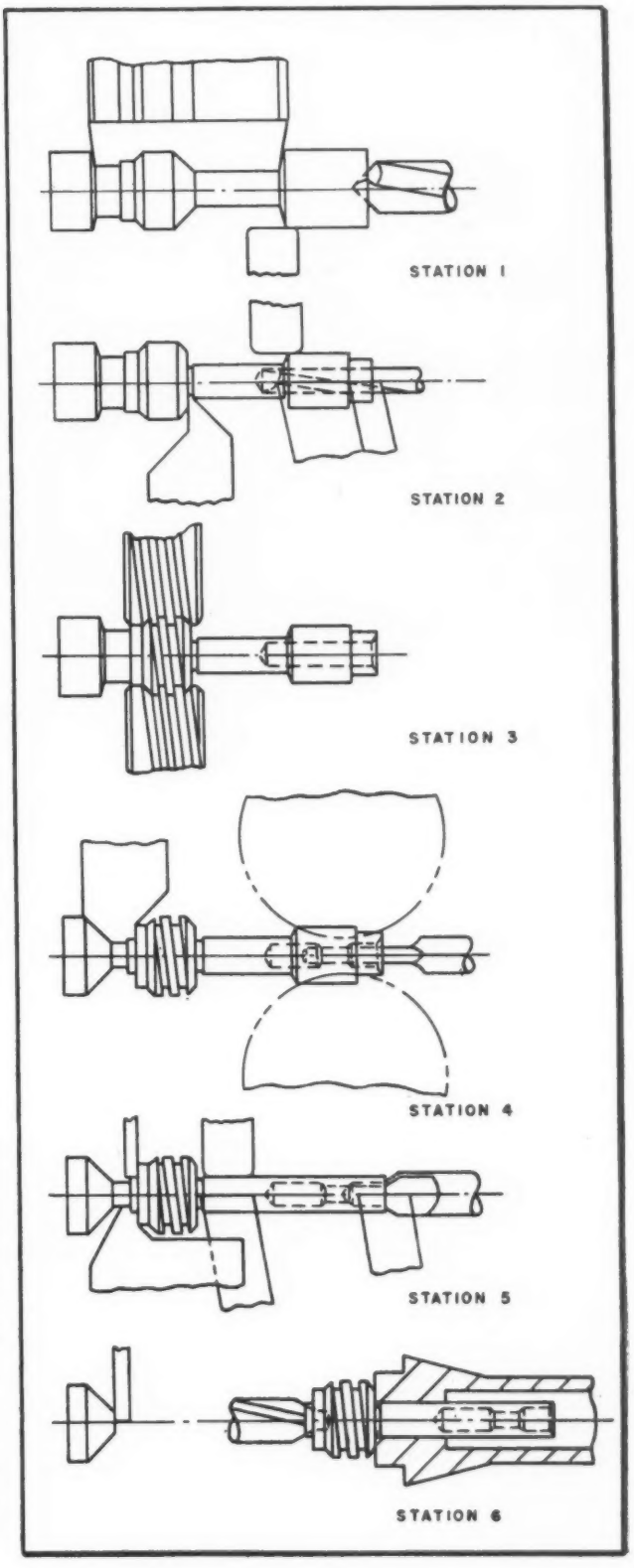
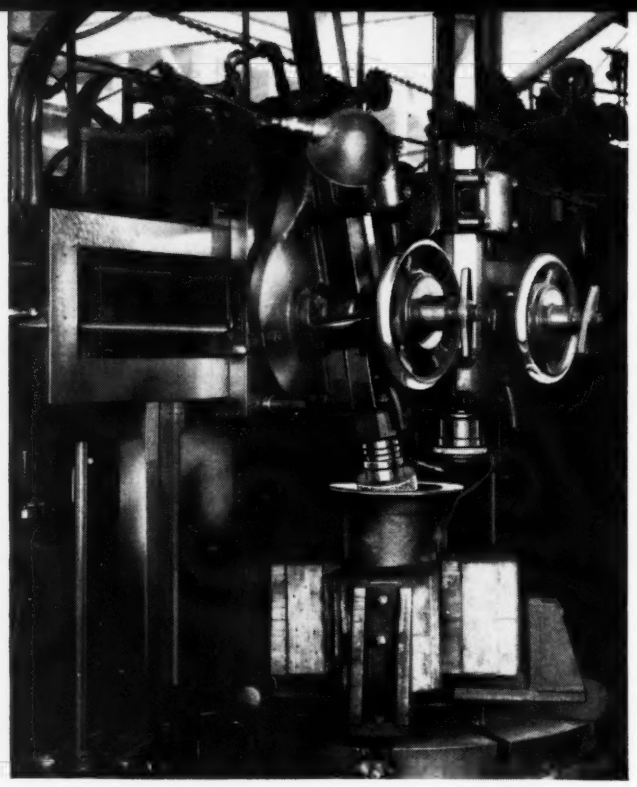


Fig. 2. Successive Steps in Producing the Brass Magnet Shaft Shown in Fig. 1 on a Six-spindle Automatic at the Rate of 720 per Hour



Toolpost Grinders in Production Operations

Second of Three Articles Describing Various Applications of Toolpost Grinders

By J. F. FISCHER
Manager, Sales Engineering
Simonds Abrasive Co., Philadelphia, Pa.

DURING the war, the heavy production demands led to new applications of many types of mechanical equipment. As an example, toolpost grinders, which had formerly been used primarily for tool-room work, proved to be well adapted for production operations. Combined with the high degree of accuracy required in the tool-room, these tools have the advantage of versatility—being suitable for cylindrical, surface, and internal grinding—low first cost, and inexpensive upkeep. Some interesting applications of toolpost grinders on production work are described in the following.

Fig. 1 shows a vertical boring mill equipped with grinding heads for grinding an internal taper and an external surface on a large part. For the internal grinding operation, a plate-mounted cylindrical wheel is used, which allows maximum wheel wear, with no interference from mounting screws. The smaller wheel, in the head at the right, grinds the rim of the casting. Thus, both external and internal grinding are done in a single set-up.

In one plant, a heavy taper was ground with a straight wheel by mounting the grinder on the bed of a lathe. This operation was performed on a production basis with a high degree of accuracy. Another application of a toolpost grinder on a lathe is shown in Fig. 2. Here the face of a part is being ground up to an internal shoulder by the use of a recessed wheel. With the work held in a chuck, this heavy job is done on a quantity-production basis, providing a mirrorlike surface, free from chatter marks or similar blemishes.

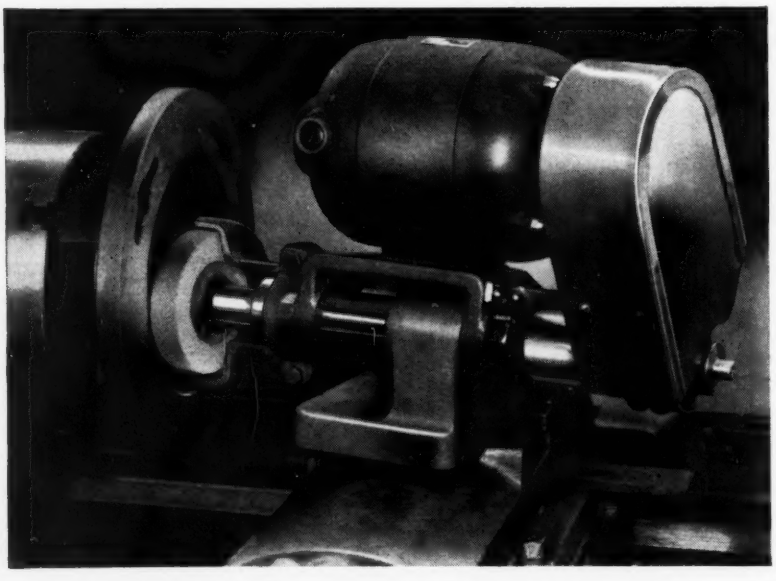


Fig. 1. (Above) An Internal Taper and the Outside Circumference of Large Work can be Ground in a Single Set-up on a Vertical Boring Mill

Fig. 2. (Left) A Toolpost Grinder Mounted on a Lathe Facilitates Special Grinding Operations

Sometimes it is desirable to dispense with the toolpost motor and drive the equipment from an outside source. In a certain case, where a gas-engine cylinder was to be ground internally to a tolerance of 0.0005 inch, it was necessary to design a special fixture with a mounting plate for holding the quill of a toolpost grinder on the bed of a lathe and to drive the grinder from the overhead lineshaft.

The grinding of valve bodies and their plugs is a cumbersome job that must be done with great accuracy. One manufacturer grinds both the bodies and the plugs with the same equipment. A toolpost grinder mounted on the compound rest of a lathe that is equipped with a taper grinding attachment is employed for this purpose. The work is chucked in the lathe headstock for internal grinding. The external grinding is done with an 8-inch wheel, and the internal grinding with a 3-inch wheel. The tolerance in both cases is 0.0001 inch, and the members are lapped together after grinding.

An unusual job consists of grinding thread segments in the eight cavities of a mold for a plastic cosmetic box. Three equally spaced thread segments, 1/4 inch long, 0.010 inch high, and having a 1/4-inch lead, are required. The tolerance for location and size is 0.0002 inch. For performing this operation, a toolpost grinder equipped with a thread grinding attachment is mounted on the compound rest of a lathe. A dividing head, taken from a milling machine, is clamped to the lathe faceplate and carefully centered. The mold block to be ground is then bolted on the flange of the dividing head and centered to within 0.0005 inch. To bring the mold cavities in position for grinding, the lathe spindle is turned by hand until a dial indicator shows that enough movement has been effected.

The production grinding of spline broaches was accomplished in one shop by adapting a surface grinder, which has the long table travel required, for the purpose. Originally, the grinder was equipped with a low-speed grinding head which was not suitable for the job. By substituting a toolpost grinder (see Fig. 3), the required high speed and precision were obtained.

Great accuracy is required in the manufacturing of gears and drive mechanisms. The grinding of gear bores is accomplished in one instance by using a toolpost grinder mounted on the head of a grinding machine. In this operation, 0.00025 inch of stock is removed, the tolerance on the bore diameter being 0.0005 inch. The work is held in a chuck on the work-head of the grinding machine.

The threads on armature shafts must also be very accurate. Originally, one shop chased them to size on a production basis. Subsequent hardening of the shafts distorted the threads. The threads are now chased to within 0.007 inch of size before hardening and then ground to size by a thread-grinding toolpost attachment mounted on the compound rest of a small lathe. Shafts that have threads at both ends are ground at the rate of twelve per hour.

One machine shop that ground clicker dies for the shoemaking industry was dissatisfied with the rate of production it was getting. As low-speed grinders were being used, the grinding wheels had to be discarded when they were worn to a diameter of less than 8 inches. Experimentation led to the installation of two sizes of pedestal-mounted toolpost grinders with tilting

Fig. 3. The Head of a Standard Surface Grinder is Replaced with a Toolpost Grinder for High-speed Grinding of Spline Broaches

tables. The most efficient speed of the wheels was found to be about 12,000 surface feet per minute. This was maintained on one machine by means of pulley changes until a 10-inch wheel was worn to 7 inches. The wheel was then transferred to the other machine, the capacity of which permitted it to be worn down to 4 inches in diameter.

In another shop it was necessary to perform three grinding operations on part of an overrunning chuck. One of the operations, which was on an oil-tight seal, was a flat surface grinding job. The second grinding operation was on an inside annular ring adjacent to the flat surface, and the third was a much smaller internal grinding operation in the spindle bore. It was essential that the internally ground diameters be concentric relative to each other within a tolerance of 0.0002 inch. To get such accuracy, it was necessary that the operations be done at a single setting.

To accomplish this, the regular head was removed from an internal grinder and replaced by the toolpost grinder, which was mounted on a special surface plate attached to the grinding machine by means of T-slots. The flat surface was first ground by means of a 60-grit cup-wheel, which was applied at a slight angle to the work as shown in Fig. 4. The larger of the two internal surfaces was then ground, with the edge of the wheel slightly flattened to permit grinding a square corner. Finally, the spindle hole was ground.

The reversed grinder set-up shown in Fig. 5 simplifies the grinding of working cams that are subsequently used for producing intake, exhaust, and fuel injection cams for Diesel engines. Here a large steel disk is mounted in place of the wheel on a standard grinding machine to act as a roller against which a master cam is actuated. The belt of a toolpost type grinder is reversed to provide the desired direction of wheel rotation. The master cam is filed to a tolerance of 0.001 inch and mounted on the shaft that carries the cams to be ground. The master cam is held in contact with the steel disk by means of pressure from an air cylinder ram. In this way, the contour of the master cam controls contact between the grinding wheel and the cams to be ground. Two cams are thus produced in two hours, as against several hours—sometimes days —required by former methods.

An eccentric sleeve is made on a high-production basis by one machine shop. The part is held by a four-jaw chuck for grinding the off-center hole to a tolerance of 0.0004 inch on one of the smallest toolpost grinders made. Although considerable time is spent in chucking, the toolpost grinder used by this shop consistently produces 175 sleeves per day, finished to a high degree of accuracy.

A fifteen to one increase in production was accomplished in another case by deburring small bevel gears with bench-mounted equipment. This set-up permits two gears to be deburred at one time. An arbor, which is driven by a V-belt, has a wire wheel mounted at one end and a gear to be deburred at the other. Another gear to be deburred is held in a fixture in proximity to the wire brush. A hand grinder fixed to a feed mechanism removes inner burrs from the end of the gear mounted on the arbor. The operator actuates the fixture near the brush with his left hand and the grinder feed with his right hand.

Fig. 4. Several Grinding Operations are Performed in One Set-up by the Use of a Toolpost Grinder on an Internal Grinding Machine

Fig. 5. An Unusual Cam Grinding Arrangement in which a Toolpost Grinder is Used in Conjunction with a Regular Cylindrical Grinding Machine

The grinding of the spherical inner surface of a universal ball joint ordinarily presents difficulties because of the inaccessibility of this surface. By using a toolpost grinder on a lathe, and simply employing a wheel smaller than the openings in the part, this can be easily accomplished. The work is held in a special fixture, and another fixture on the compound rest of the lathe allows the toolpost grinder to be swivelled, so that the wheel operates in an arc of the correct radius. The whole inner surface of the revolving work contacts the wheel.

Toolpost grinders mounted on lathes were used for grinding two mating parts of a poppet valve. On the larger part, the outside diameter of two fins had to be ground to a tolerance of minus 0, plus 0.0005 inch and the face had to be flat surface ground. On the smaller part, two middle fins and a taper on the end were ground to tolerances similar to those applied to the mating part. The production obtained with four grinders was 600 sets of the two parts per day.

* * *

A new product service is being offered to manufacturers who desire to get in touch with inventors having patents for sale or for lease. The service consists of a pamphlet entitled "Inventors' Sales Bulletin," which lists firms who are in the market to buy inventions, and the types of products wanted. The bulletin circulates among inventors, and sells for $1 a copy. No charge is made for the manufacturers' announcements. Further information can be obtained from V. D. Angerman, publisher, *Science and Mechanics*, 49 E. Superior St., Chicago, Ill.

Prizes for Resistance Welding Papers

The Resistance Welder Manufacturers Association is sponsoring a contest for the six best papers from industrial and academic sources submitted to the American Welding Society prior to August 1, 1949. Prizes amounting to $1500 will be awarded for the three best papers from an industrial source dealing with such topics as the redesign of a product for lower cost manufacture by resistance welding; product improvements through the use of resistance welding; resistance welding research; and the development of new procedures which broaden the usefulness of resistance welding.

In the academic field, three prizes totaling $750 will be given—two to a university instructor or research fellow for papers constituting original contributions to the advancement and use of resistance welding, and the third for the best paper by an undergraduate student. Copies of the rules governing the awards are available from the Association, 505 Arch St., Philadelphia 6, Pa.

* * *

Films for Foreman Training Program

A new series of six 35-millimeter sound slide films entitled "Human Factors in Safety," has been developed by the National Safety Council. The films comprise a visual training course for foremen, dealing with production and job attitudes, as well as safety. Supervisors are shown how to train new workers, how to keep experienced workers alert, and how to handle people. For further information, address the Council at 20 N. Wacker Drive, Chicago 6, Ill.

Engineering News

Cam Engine for Aircraft Combines High Power with Reduced Vibration

A six-piston cam engine for aircraft has been designed by the Herrmann Engineering Co., Glendale, Calif., which develops 180 to 200 H.P. at 1800 R.P.M. Supercharged, it is claimed to have developed 225 to 270 H.P. at 1500 R.P.M. for fifty hours without measurable wear. The main cam is so designed that the six double-ended pistons have harmonic motion. Reciprocal forces of the pistons are thus eliminated, and not transmitted to other engine parts. This relieves the shaft, bearings, etc., of destructive friction and fatigue loads. The cam engine provides twelve overlapping power strokes per revolution, so that a nearly uniform torque is obtained and vibration is reduced. The cylinder block has an over-all length of 49 inches and a diameter of 12 3/4 inches. The complete weight of the engine, including the starter and generator, is 286 pounds.

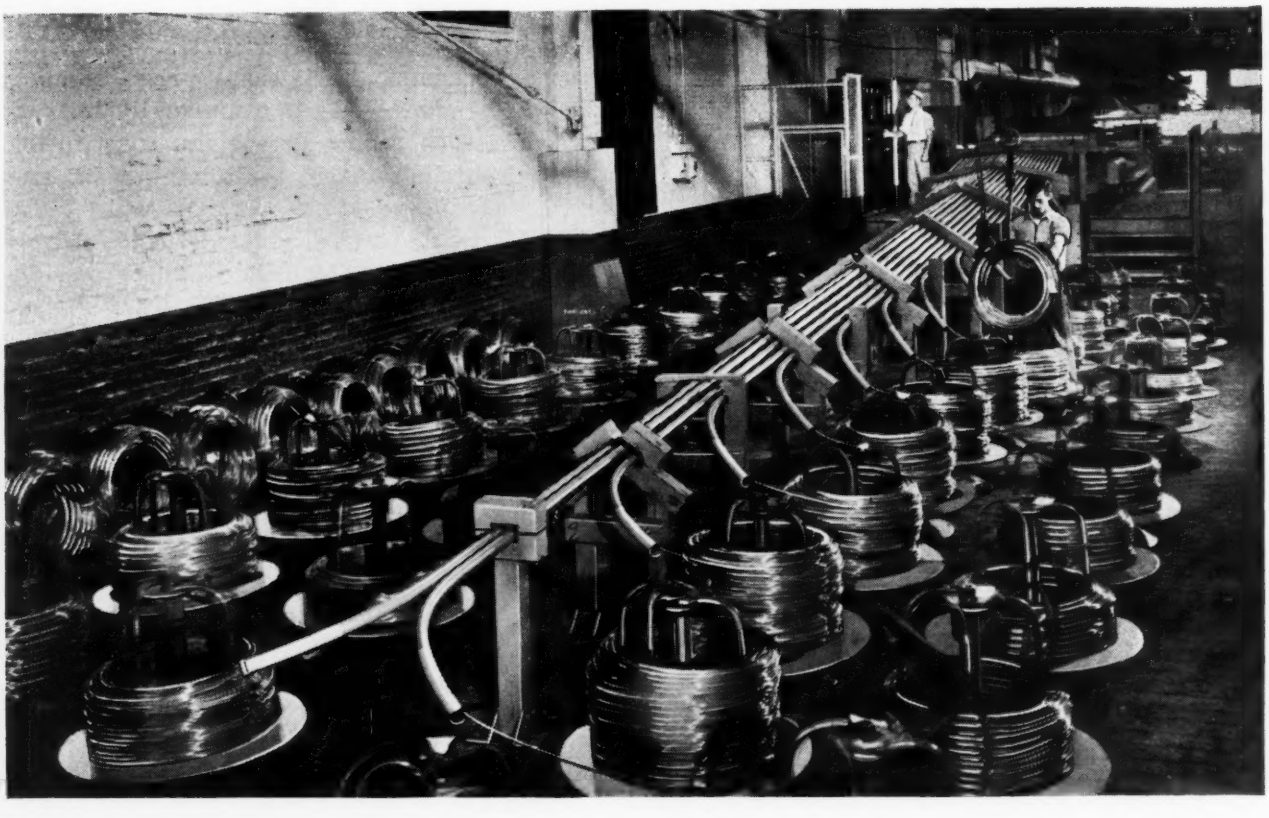
Atomic Clock Offers New Standard of Frequency and Time

A new standard of frequency and time—an atomic clock based on a constant natural frequency associated with the vibration of the atoms in the ammonia molecule—has been developed by the National Bureau of Standards. This is the first atomic clock ever built, and it promises to surpass the accuracy of the present primary standard—the rotating earth.

The atomic clock may be expected to benefit greatly the communications industries and the military services, for it will, in effect, provide room in the radio frequency range for additional communication stations of all types. High frequencies, used by radar, television relays, and micro-wave equipment in general, could be controlled by atomic elements. Such control would also make possible the permanent establishment of radio channels on an exact basis.

An absolute time standard will also be of spe-

Electric Annealing Unit that Simultaneously Handles Wire for Twenty-four Reels in the Aliquippa Works of the Jones & Laughlin Steel Corporation



cial importance in astronomy, in long-range radio navigation systems, in the upper range of the micro-wave region where atomic systems can serve as elctronic components, and in basic research in micro-wave spectroscopy and molecular structure.

The new development uses an absorption frequency of ammonia to hold a micro-wave signal fixed. If the micro-wave signal output of a generator differs in frequency from the ammonia absorption line, then the control circuits generate an "error signal" which brings the micro-wave signal back to the frequency of the spectrum line. The quartz-crystal oscillator which generates the micro-wave signal is thus controlled, and the setting of the clock it drives can be compared with an astronomical clock.

Vitreous Enamels Increase Corrosion Resistance of Aluminum

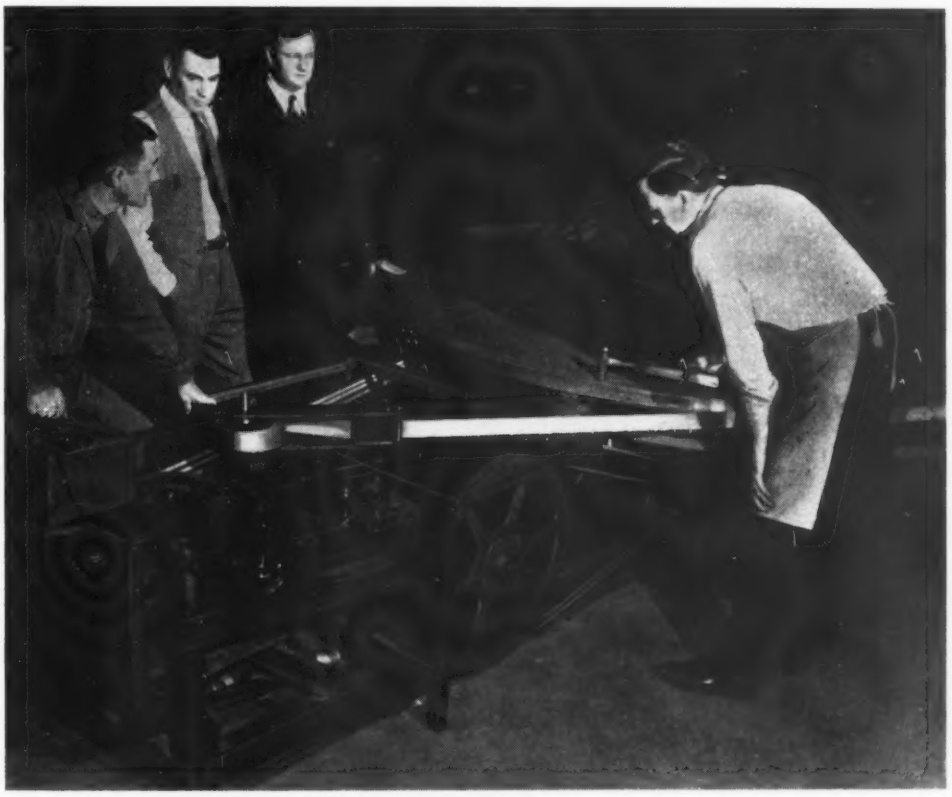
After six years of research by the du Pont Co., vitreous enamels have been developed for some alloys of aluminum. The enamels are fired on aluminum strips, sheets, and castings in furnaces similar to those used for applying porcelain to steel, except that the temperatures employed are several hundred degrees lower.

Enameling of aluminum to increase its resistance to corrosion and widen its decorative uses will broaden its usefulness, particularly outdoors where it is subject to weather and the corrosive effects of the atmosphere. Enameled aluminum is unusually resistant to marring, but if it is accidentally chipped or cracked, the aluminum will not develop unsightly rust. Satisfactory enamels for two alloys of aluminum—61-S wrought alloy and 43 casting alloy—have been developed thus far.

Electronic Control for Deep Oil-Well Drilling

An automatic electronic control that provides the desired weight for a drill bit under all conditions as it penetrates oil-bearing formations thousands of feet below the earth's surface has been announced by the Brown Instruments Division of Minneapolis-Honeywell Regulator Co. The system makes use of a strain gage assembly, an electronic potentiometer which operates as a weight indicator on the drilling bit, and a pneumatic brake which maintains the desired weight. The brakes feed the drilling line at a rate which assures a predetermined, constant weight on the bit through all types of subsurface formations.

The growth in importance of providing automatic feed and uniform weight is due to increasingly deeper drilling, which entails greater drill-pipe torque, and to a decreasing sensitivity of heavier equipment to the "feel" of the driller.



Winding One of Fourteen Large Copper Coils for the Cyclotron being Built by the University of Washington in Seattle. Each Finished Coil Weighs 17 Tons and is Constructed from 3-inch Copper Strip. Ten Miles of Strip was Required for Fourteen Coils

How Tempering Affects Tool

The Effect of Single and Double Tempering Operations on the Structure and Properties of Typical Tool and Die Steels — Last of Three Articles

THE final step in the heat-treatment of tool steels is tempering, the primary purpose of which is to toughen the steel. The tempering treatment consists of reheating the hardened steel to a temperature that is governed by the composition of the steel and its application, and then cooling it to room temperature, usually in air. The hardness of the steel is decreased by tempering, but the improvement in toughness compensates for this.

It is difficult to evaluate toughness in hardened tool steel. A number of testing procedures have been used, but none is universally accepted. A service test generally has to be made to establish the advantage of any particular treatment, because it is difficult to create in the laboratory the conditions under which a tool may fail in service. The degree to which a steel is tempered, therefore, is still more or less according to rule-of-thumb, and depends mainly on experience.

The effects of reheating on the hardness of the five steels that have been discussed in this series of articles are shown in Fig. 1. These relationships are correct for the steels as hardened conventionally. The change in hardness depends not only on the reheating temperature, but also on the time that the steel is reheated. It is possible to develop the same hardness with a fairly wide range of temperature if the reheating time is varied. The results obtained at a high temperature in a relatively short time can generally be reproduced at a lower temperature if a long enough time is used.

The relationships shown in Fig. 1 would hold only for a uniform time—say one hour—at each temperature. Ordinarily, heating the steel at the required temperature for two to four hours is considered preferable to a shorter time, particularly for large sections, as the longer heating allows equalization of temperature throughout the section.

It is apparent that reheating at about 300 to 350 degrees F. has little effect on the hardness of any of these steels. The carbon tool steel and the manganese oil-hardening steel are used with a temper as low as this, in order to retain as much wear resistance as possible. Since they both have only a small amount of residual carbides, their wear resistance depends mainly on the hardness of the tempered martensite, and they are used widely at a hardness of 62 to 64 Rockwell C.

In the shallow-hardening carbon tool steel, the residual internal stresses near the surface of

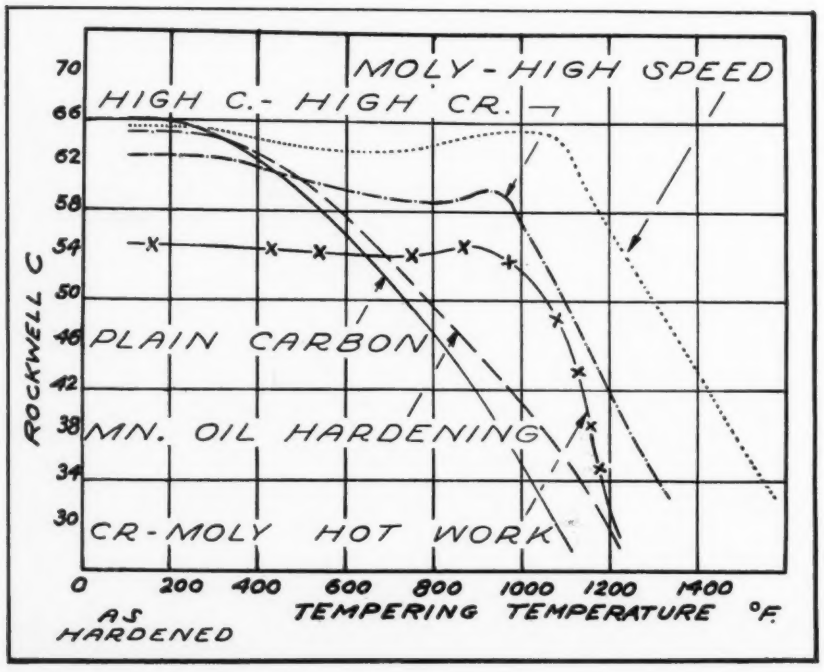


Fig. 1. Hardness versus Tempering Temperature for Five Different Steels. Plain Carbon and Oil-hardening Tool Steels are Usually Tempered at 300 to 350 Degrees F.; High-carbon, High-chromium Steel at 450 to 550 Degrees F.; Hot-work Steel at 1100 to 1150 Degrees F.; and High-speed Steel Twice at 1050 Degrees F.

and Die Steels

By PETER PAYSON
Assistant Director of Research
Crucible Steel Co. of America

the hardened tool are in compression, and therefore are effective in counteracting applied tensile stresses. For this reason, it is desirable in some applications not to relieve these internal stresses by tempering.

The high-carbon, high-chromium steel is generally tempered at between 450 and 550 degrees F. to a hardness of about 58 to 60 Rockwell C. The high-speed steel can be tempered twice at 1050 degrees F. to a hardness of 63 to 65 Rockwell C when used for cutting purposes; and it can be tempered at temperatures as high as 1100 to 1150 degrees F. to a hardness of 58 to 60 Rockwell C when employed for other than high-speed cutting purposes.

The hot-work steel is usually tempered at between 1100 and 1150 degrees F. to a hardness of about 42 to 48 Rockwell C. Although wear resistance is sacrificed at this relatively low hardness, it has been found that hot-work tools tend to split if they are used at a higher hardness. Furthermore, in many severe hot-work jobs, the surface of the tool attains a temperature at least as high as 1150 degrees F., and would automatically become tempered to the lower hardness even though it was put into service at a higher hardness. On the other hand, it is desirable to keep the hardness of the hot-work steel as high as possible, in order to minimize heat checking, which is the ultimate cause of failure of practically all hot-work tools.

The Effect of Double Tempering

Double tempering is used in the treatment of high-speed steel tools to stress-relieve the martensite, and to convert the austenite that is retained in the steel to martensite. After the steel is hardened by being cooled from the austenitizing temperature (2250 degrees F.) to room temperature, it is reheated to 1050 degrees F. and held at that temperature for two hours; cooled to room temperature; reheated to 1050 degrees F. and held at that temperature for an additional two hours; and then cooled to room temperature.

The sequence of changes that take place during this treatment of high-speed steel is illustrated schematically in Fig. 2. In the hardening operation (indicated in the column at the left) the steel is all austenite, designated by the unshaded areas, as it starts to cool from 2250 degrees F., and it remains all austenite as it cools past 1050 degrees F. down to the martensite

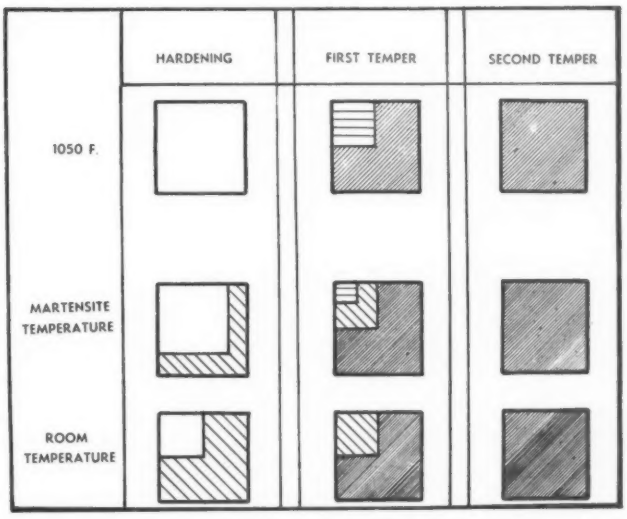


Fig. 2. Diagrams Showing the Effect of Double Tempering on the Structure of High-speed Steel. White Indicates Austenite; Horizontal Sectioning, "Conditioned" Austenite with Carbides Precipitated; Cross-sectioning, Untempered Martensite; and Dark Shaded Areas, Tempered Martensite

temperature. As the steel cools below the martensite temperature, martensite (designated by the sectioned area) begins to form, and continues to form until about 80 per cent of the structure is transformed to martensite at room temperature. The unshaded area represents the austenite retained at room temperature.

The middle column shows the changes that occur in the first tempering operation. When the hardened steel is reheated to 1050 degrees F., the martensite becomes tempered, as indicated by the dark shaded area. At the same time, the retained austenite is not transformed to martensite, but it does undergo a change. This change consists of a precipitation of alloy carbides from the austenite, and the precipitation, which has become known as the "conditioning" of the austenite, lowers the alloy content of the austenite, but does not change its structure. This is designated by the section with horizontal lines. When the steel is cooled below the martensite temperature, the conditioned austenite begins to transform to martensite.

The martensite that was tempered during heating remains tempered martensite when the steel is at room temperature. There is, then, a mixture of tempered and untempered martensite in the steel at the end of the first temper. The untempered martensite is internally stressed, and it is desirable to relieve these stresses be-

Effect of Hardening Temperature on Final Hardness of High-Speed Steel

Austenitizing Temperature, Degrees F.	Rockwell C Hardness		
	As Quenched	Single Tempered at 1050 Degrees F.	Double Tempered at 1050 Degrees F.
2100	66.0	61.5	61.0
2150	66.0	63.0	62.5
2200	66.0	64.0	63.5
2250	65.5	65.0	64.5

fore the tool is put into service. Therefore, the steel is again reheated to 1050 degrees F., and the untempered martensite that was present after the first temper is finally tempered. No further changes take place during cooling, after which the tool is ready for service.

As mentioned in the first article in this series (see January MACHINERY), the heating temperature for hardening the higher alloy steels may affect the hardness of the steel after it is tempered. This is shown in the accompanying table, where the hardness is given for the molybdenum high-speed steel as quenched from 2100 to 2250 degrees F., and for the same samples when single tempered at 1050 degrees F. and when double tempered at the same temperature.

It is clear that although the hardness of the samples as quenched is practically the same for all, the hardness after tempering is lower. The reason for this is that the hardness after tempering is dependent upon the precipitation of alloy carbides from the martensite and from the retained austenite during the tempering operation; and the amount of alloy that can be precipitated depends on the amount dissolved in the austenite during the heating for hardening. The amount of alloy carbides which dissolves in the austenite increases with increasing heating temperature, particularly above 2100 degrees F. and therefore, the higher the original heating temperature the greater is the amount available for precipitation during tempering. Since the minimum hardness for good cutting efficiency in a high-speed steel is about 63 Rockwell C, it is clear that poor cutting efficiency may be expected from molybdenum high-speed steel tools that are hardened at temperatures under about 2200 degrees F.

Size Changes During Heat-Treatment

Any article on heat-treatment would not be complete without some mention of the changes in size that occur in parts during the process. While this subject would require a series of articles to cover it completely, the major factors can, at least, be listed here.

In the first place, steel, like all metals, expands when it is heated and contracts when it cools. In the second place, austenite is denser than any of its transformation products, all of which have different densities. The lower the temperature at which the transformation product forms, the lower is its density, martensite having the lowest density of all. In other words, when austenite is cooled so that it eventually transforms into martensite, the steel first contracts because of the drop in temperature, but as soon as martensite begins to form, the steel expands because of the difference in density between the austenite and martensite. In the third place, when martensite is tempered, the density of the steel increases; that is, the tempering of martensite causes the steel to shrink in size.

The successive changes during the heat-treatment of steel, therefore, are first a contraction while the austenite cools, then an expansion when the martensite forms, and finally a contraction when the martensite is tempered. This is further complicated if, during the hardening treatment, all of the austenite does not transform, but is partially retained at room temperature, together with martensite. When this mixture of austenite and martensite is tempered, the steel shrinks at first, and then expands if, during the tempering, some of the retained austenite is transformed.

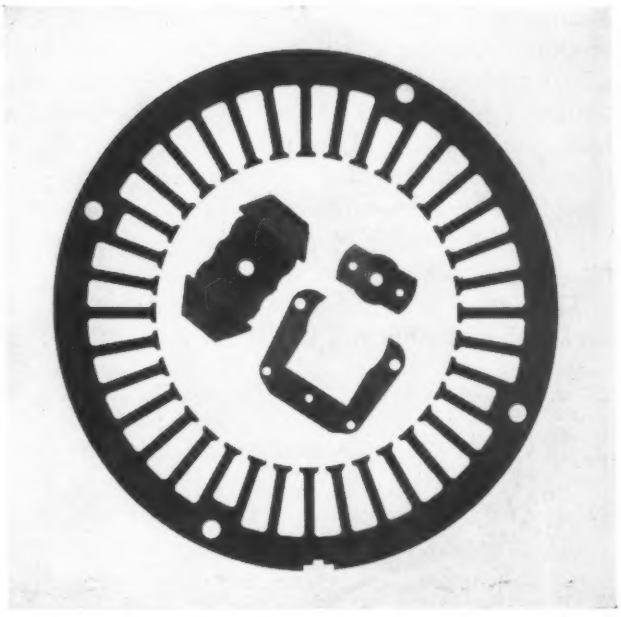
On top of this, there are size changes brought about by the fact that in water quenching, and also in oil quenching of some sections, there are sizeable temperature gradients from outside to center which may set up sufficient stresses to introduce shrinkage in some directions and expansions in others. However, in spite of all these sources of error, a large percentage of tools and dies is heat-treated satisfactorily without cracking and within reasonable size tolerance. For this, a great deal of credit is due to the skill of the heat-treater and to the quality of the tool steel.

* * *

Brown & Sharpe Apprentice Reunion

Arrangements are being made for the fourth reunion and banquet of the graduate apprentices of the Brown & Sharpe Mfg. Co., Providence, R. I. The affair will take place at the Sheraton-Biltmore Hotel in Providence on the evening of May 21. About 400 graduates attended the third reunion in 1946, and it is expected that a much larger number will be present this year.

Higher Output with Carbide Lamination Dies



IN order to increase the efficiency of punch presses, and thus decrease unit production costs, manufacturing engineers have been devoting considerable attention for several years to the development of carbide dies for blanking, shaving, and punching high-production parts. The application of such dies in the manufacture of electric motor and transformer laminations is of special importance, since these parts are usually produced on automatic presses and dieing machines, and die maintenance is a considerable item.

So successful has carbide proved in applications of this kind that it is being employed whenever the number of parts to be made is large enough to justify the greater initial die cost. A progressive die made of carbide costs, on an average, four times as much as an ordinary steel die, but its life is twenty times greater and it produces twenty-five to thirty times more stampings per grind. Contrary to expectations, not much trouble is experienced from chipping, provided the die is properly designed and used on a press or dieing machine that is in good alignment and is well maintained.

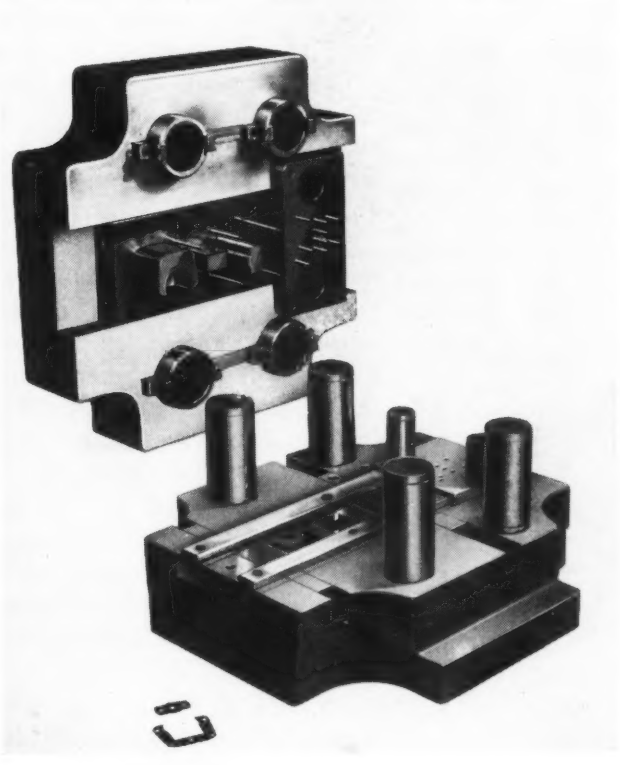


Fig. 1. Five-stage Progressive Carbide Die for Blanking Rotor and Stator Laminations for Electric Shavers

The design of a carbide die does not differ basically from that of an all-steel die, except that the guide pins and die-bolster are made heavier to insure accurate alignment and prevent deflection; also, tolerances on the finished carbide sections are closer, often being held to millionths of an inch. It is these factors, plus the principles employed in segmenting and finishing the carbide sections and in attaching them to the punch-holder and bolster-plate, that determine the success or failure of the application.

A progressive carbide die is used to produce rotor and stator laminations for the electric shaver made by Schick Incorporated, Stamford, Conn. The punches and die sections are of carbide, as are the guide pins, pick-up pins, and guide bushings. The complete die set is shown in Fig. 1, while plan and cross-sectional views are seen in Fig. 2, where the carbide inserts are clearly indicated.

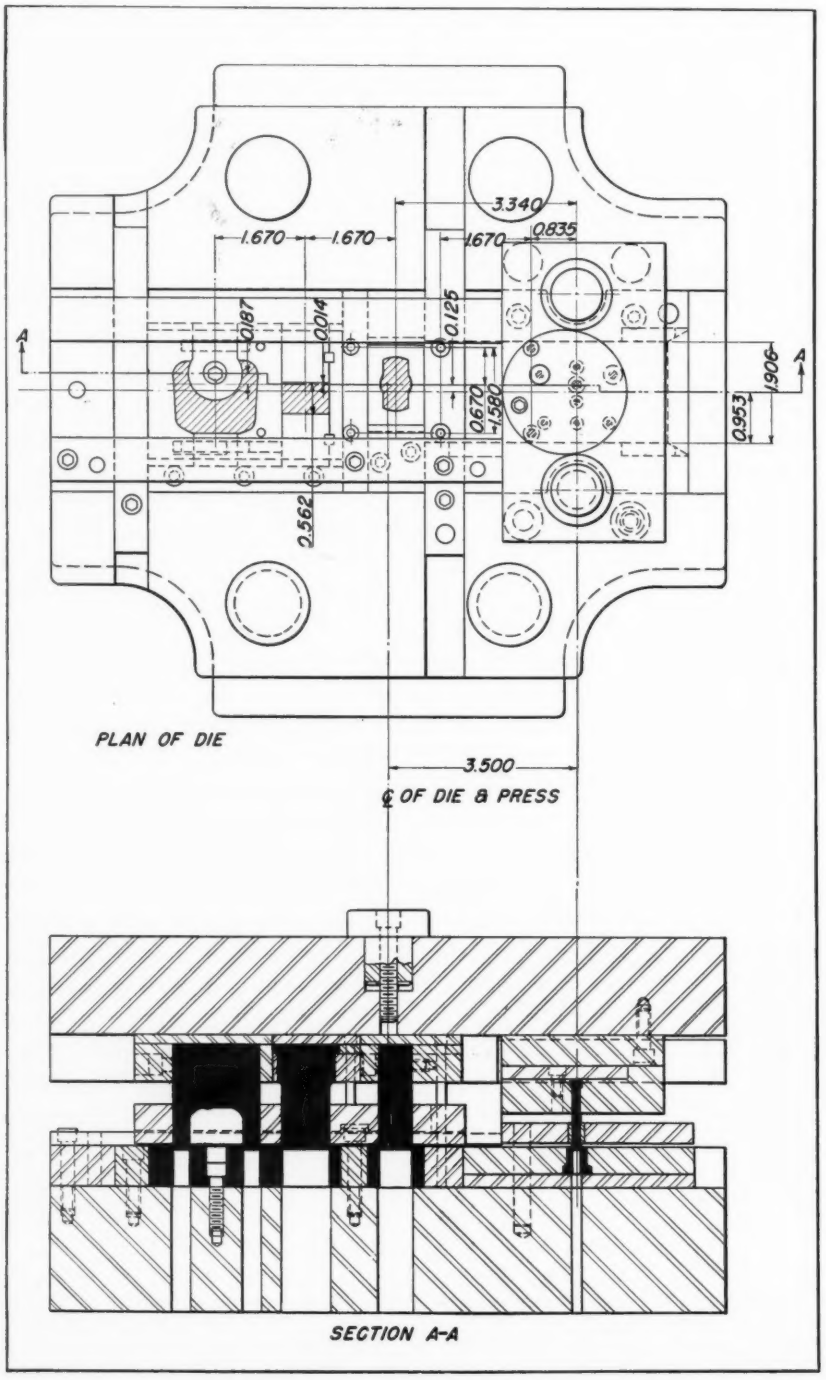
The carbide sections are of segmental construction and are clamped in position by steel hold-down screws. All parts are precision-ground and lapped to close tolerances. The guide pins are 1 1/2 inches in diameter, as compared with 1 1/8 inches in diameter on the previous steel die, and stop-buttons on the die facilitate set-up on the press and eliminate over-travel and consequent wear of the punches.

This die is used on a 25-ton Henry & Wright dieing machine. Up to the present, the punch has been able to produce approximately thirty-

five times the number of parts that can be stamped on a conventional cold steel die before regrinding becomes necessary. Some production engineers feel that there may be advantages in stopping the die after an arbitrary number of punchings—long before it begins to show any tendency to produce a burr. With this practice, less material would need to be removed per grind from the carbide sections and the die life might be considerably lengthened. However, this is still a matter of conjecture, and should be substantiated by greater experience.

The large increase in stampings per grind obtained with this die is not all gain, however, since four days are required for grinding the carbide die, while only one day is necessary with a steel die set. This difference is due to the fact that the carbide sections must be removed and ground separately. New die designs provide for relief of the steel die block below the carbide sections to permit grinding after assembly.

Several carbide dies are in use at the Fort Wayne, Ind., Works of the General Electric Co. One of these, typical of transformer lamination push-through type punch and dies, blanks an L-shaped transformer lamination from strip stock that is automatically unrolled and fed into the die. The material is 3 per cent silicon steel, 0.025 inch thick. The carbide parts of this die also are made in sections to secure adequate strength, insure greater accuracy, and permit replacement of damaged die parts in case of an accident. (Small pieces can be more accurately preformed than larger pieces and fewer internal stresses are set up in sintering them.)



There are two common methods of fastening such sections. First, they may be keyed to one another, and second, they may be held in position either by cap-screws passing through the carbide and into the bolster; by cap-screws passing through the punch-holder or bolster-plate and into the carbide; or by steel hold-down clamps, as shown in Fig. 3.

The bolster of this lamination die is 1 1/2 times heavier than a comparable unit for an all-steel die, and is scraped to provide flat surfaces and hence rigid support for the inserts. Three steel guide pins (2 inches in diameter as compared with 1 1/2 inches in diameter for a steel die) are fitted into the die-bolster and three drawn-in steel bushings are used in the punch-holder.

Fig. 2. Details of Punch and Die Shown in Fig. 1. Guide Pins, Guide Bushings, Pick-up Pins, Punches, and Die Sections are Made of Carbide, as Indicated by Solid Black in Section A–A

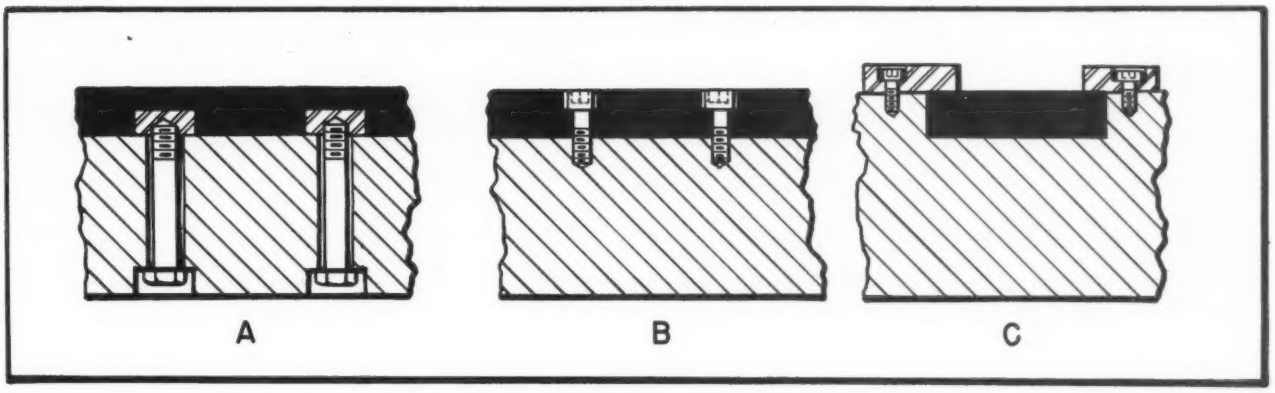


Fig. 3. Methods of Fastening Carbide Sections to the Bolster-plate Include (A) Cap-screws Passing through the Bolster-plate and into Brazed-in Steel Inserts in the Carbide; (B) Cap-screws Passing through the Carbide Sections and into the Bolster; and (C) Steel Hold-down Clamps

Drive fits are not employed because they often result in some distortion during assembly.

The bushings are designed with an oil well to hold the lubricant and maintain a full fluid film of oil on the guide pins. Carbide is not used for the guide pins. Since the die is designed for use on a high-speed automatic press having a 1-inch stroke, the wear on the pins is too small to cause misalignment, and hence not enough to justify the use of carbide.

The relief in the die is 0.003 inch per inch over all, and the clearance between the punch and die is 0.00125 inch per side. Another feature of note is that all carbide sections are made to project above the bolster so that they can be sharpened without being removed. Otherwise, the grinding wheel would become loaded with the softer steel or cast iron from the bolster and make sharpening impossible.

In operation, this die has averaged about twenty-eight times more stampings per grind than a steel die. It or other dies in use have not chipped excessively, even though occasional mispunchings have occurred. It has been found that so long as the punch is in alignment with the die, mispunchings have little effect on the carbide sections.

Carbide dies are also being applied at this General Electric plant to the stamping of electric motor stator and rotor laminations. A multiple blank stator and rotor die that will produce five stator and five rotor blanks at each stroke of the press is now being designed. Approximately 37 by 28 inches over all, it will blank a stator section 6.294 inches in diameter and a rotor section 3.682 inches over all.

Another carbide die is used to punch the stator lamination shown in the heading illustration. It is composed of thirty-six carbide segments, 3/4 inch in length, which are held in the bolster with a conventional bowl ring. Carbide guide pins and bushings are used to guide the stripper and to act as stabilizers for the punches. Ball-bearing guide pins are employed; the punch-holder and bolster are larger than usually found in dies of this size; and the clearances and relief are the same as for the transformer lamination die.

Used in an automatic inclinable press equipped with micro-switches to insure that the blank is properly seated, this die has produced one run of 592,000 laminations without being reground. Other carbide dies in operation in General Electric plants include shaving dies for removing 0.006 inch from the inside bore of a stator blank, blanking dies for stamping E- and I-shaped transformer laminations, and a progressive die for punching and forming transformer wedges. Carbide is applied only in the last or forming stage of the last-mentioned die, a practice feasible when only one stage is subjected to severe wear.

All the applications described have involved single-stage or progressive dies. This is not because compound dies are impractical, but rather because the large pieces of carbide required for their construction are difficult to preform and fasten to the bolster without inducing strain. Therefore, such dies are inherently weaker than progressive units. For this reason, and because of the added complexity of the compound die, progressive dies are recommended for ordinary shaving, punching, or forming operations.

* * *

Motor vehicles use half the malleable iron produced in the United States, 75 per cent of all plate glass, 80 per cent of the crude rubber, 90 per cent of the gasoline, 68 per cent of all upholstery leather, 37 per cent of the mohair, and 23 per cent of the nickel.

Proposed Gage Manufacturing Tolerances

The article "Proposed Gage Manufacturing Tolerances" by Gilbert A. Marshall, which appeared in December, 1948, MACHINERY, drew the following comments from J. E. Van Acker, quality control supervisor of Gould & Eberhardt, Inc., in a letter directed to the author:

"Dear Mr. Marshall:

I would like to commend you on your efforts in preparing the article on proposed gage manufacturing tolerances. Your article is in almost perfect agreement with my own sentiments on the subject. However, your Table 4 listing snap and flush-pin gage tolerances appears to have an error in it.

In the first place, I have always preferred to keep snap and flush-pin gages in separate categories, as flush-pin gage wear is on two surfaces which usually face in the same direction. Wear can be either plus or minus, depending on which element wears first. Secondly, your wear allowance specified in Table 4 appears to be in the wrong direction for snap gages. Assuming a snap gage is made for a shaft whose diameter is specified as 1.000 inch (+ 0.0000 — 0.0002), according to your table the "Go" gage when new would have maximum and minimum limits of 1.00000 and 0.99998 inch, respectively. Any wear on the internal surfaces of this gage would cause the size to increase, but you specify that the gage is worn out when the tolerance is — 0.00005 inch, or as I interpret your table, when the gage in my example is 0.99995 inch. In order for a snap gage to change from 0.99998 to 0.99995 inch, material must be added to the gaging surfaces, and wear will remove, not add, material.

If I am misinterpreting the table, surely others must have the same trouble. Could you please correct me?"

Mr. Marshall replied as follows:

"Dear Mr. Van Acker:

I am pleased to learn that my proposal has your support. The error in Table 4 of my article which you have pointed out is a rather embarrassing one. Your interpretation is correct, and I am enclosing a revised Table 4 which I hope will answer your question. [See accompanying table.]

In reply to your comment on flush-pin gages, I should explain that the flush-pin gages with which I have been concerned wear in the same direction as snap gages. The term is rather ambiguous since, of course, the flush-pin principle may be applied to nearly any type of gage. Upon your suggestion, I have deleted that term from the title of the revised Table 4, as here shown."

Table 4. Snap Gage Tolerances* (Revised)

Total Tolerance on Work	"Go" Gage		"Not Go" Gage	
	New	Worn out	New	Worn out
— 0.0002	— 0.00002 — 0.00005	— 0.00000	— 0.00018 — 0.00020	— 0.00016
— 0.0003	— 0.00004 — 0.00008	— 0.00000	— 0.00027 — 0.00030	— 0.00025
— 0.0005	— 0.00006 — 0.00012	— 0.00000	— 0.00046 — 0.00050	— 0.00042
— 0.001	— 0.00010 — 0.00020	— 0.00000	— 0.00095 — 0.00100	— 0.00090
— 0.0015	— 0.00012 — 0.00025	— 0.00000	— 0.00145 — 0.00150	— 0.00140
— 0.002	— 0.00015 — 0.00030	— 0.00000	— 0.0019 — 0.0020	— 0.00185
— 0.003	— 0.00020 — 0.00035	— 0.00000	— 0.00285 — 0.00300	— 0.00275
— 0.005	— 0.00030 — 0.00050	— 0.00000	— 0.00480 — 0.00500	— 0.00470
— 0.010	— 0.00040 — 0.00070	— 0.00000	— 0.0097 — 0.0100	— 0.00955
— 0.015	— 0.00050 — 0.00090	— 0.00000	— 0.0144 — 0.0150	— 0.0140

*All values in inches.

* * *

Buyer's Comparison Chart for Multiple-Spindle Automatic Bar Machines

The Cone Automatic Machine Co., Inc., Windsor, Vt., is distributing a buyer's comparison chart for multiple-spindle automatic bar machines, listing such items as work and tool capacity, job setting capacity, work and tool support, power capacity, work and tool maintenance, and other essential information on machines of this type. Space is provided so that the buyer can fill in the data applying to various makes of machines to serve as a convenient comparative record in selecting the machine best adapted for his requirements. Copies can be obtained by applying to the company.

* * *

Stainless steel wool should be used for cleaning stainless steel equipment to prevent surface contamination by other metals.

New Developments in Centerless Thread Grinding

By CECIL W. HOPKINS
Chief Engineer, Landis Machine Co.
Waynesboro, Pa.

THREADS up to 1 7/8 inches in diameter and as coarse as 8 per inch can now be ground economically from the solid on the centerless thread grinder built by the Landis Machine Co. as the result of recent improvements in grinding wheel and machine construction. When this machine was first introduced on the market, it was limited to grinding small screws and other parts having fine-pitch threads. Improvements in grinding wheels suitable for crush-dressing, the development of an "up-cutting" centerless grinding method, and important changes in the machine construction have resulted in greater versatility of the grinding machine and have also increased its economy and productivity.

Developments in the Through-Feed Process

The through-feed method of centerless thread grinding is used for work-pieces requiring threads on the largest diameter and having no shoulders or heads to prevent passage of the work between the grinding and regulating wheels. This class of work includes headless set-screws of the socket or slotted types, rods, bushings, and continuously threaded studs. Fig. 1 shows a group of such parts ranging in size from 1 7/8 inches in diameter with 8 threads per inch to No. 6 screws with 32 threads per inch. The threads on all of these parts were ground from the solid in a single pass, it being unnecessary to precut the threads before the centerless thread-grinding operation. The process is used for generating either right- or left-hand threads.

The grinding wheel used in through-grinding usually has a plain section without thread-forming ribs at the side where the work-pieces enter the grinding throat. This plain section is used to grind the outside diameter of the work-piece prior to the generation of the threads. The thread-generating ribs between the plain section of the grinding wheel and the exit side are of varying cross-section, so that the threads are progressively generated as the work passes through the throat of the machine. The last few thread ribs at the exit side of the wheel are

Fig. 1. Parts Ranging from 1 7/8 Inches in Diameter with 8 Threads per Inch down to No. 6 Screws with 32 Threads per Inch which have been Centerless Ground by the Through-feed Process

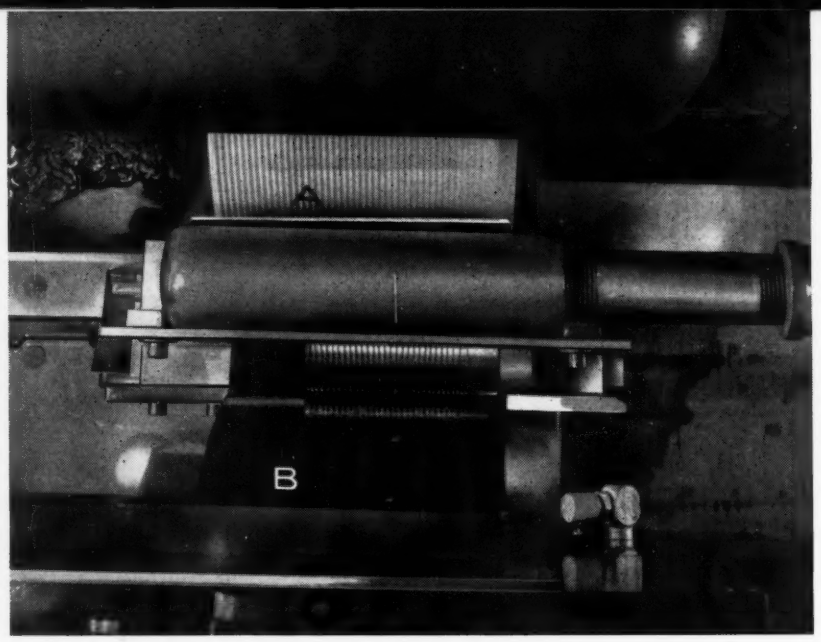


Fig. 2. Grinding a Continuously Threaded Stud by the Through-feed Process. The Grinding Wheel is Seen at A and the Regulating Wheel at B

of full thread form, thus producing the final size and form of the thread on the work.

One of the improvements in grinding wheels for this process is the availability of wheels of dual specifications. There is one set of specifications for grit, structure, and hardness of the plain section of the wheel that will give the maximum efficiency in grinding the outside diameter of the work-piece, and another set of specifications applying to the thread-generating wheel section that will give highest efficiency in grinding threads.

A continuously threaded stud being ground by the through-feed process with a grinding wheel made in the manner described is shown in Fig. 2. The grinding wheel is seen at *A* and the regulating wheel at *B*. The blank studs are cut to length from hot-rolled bar stock and the ends chamfered, after which the studs are heat-treated before the thread-grinding operation. It is not necessary to turn or grind the outside diameter of the hot-rolled bar stock prior to the centerless thread grinding.

As shown in the illustration, the work-piece is traversing from right to left through the throat between the grinding and regulating wheels. The thread on the left-hand end of the stud is nearing completion, and at the right-hand end of the piece, the outside diameter is being ground prior to passing into the thread-generating zone. The manner of gradually forming the thread on the stud can be seen. Changes made in the construction of the Landis Machine Co.'s No. 1 centerless thread grinder have permitted the use of 6-inch wide grinding wheels, and the power input to the grinding wheel has been increased to 25 H.P. for use, when required, in heavy-duty thread grinding. The diamond profile dressing devices are now provided with a hydraulic power traverse, and have been increased in capacity

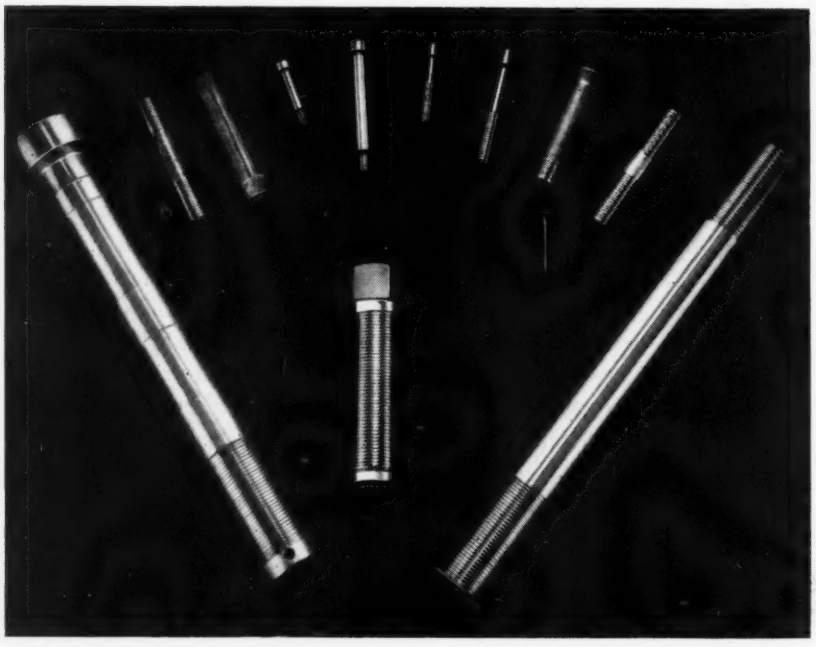


Fig. 3. Such Parts as Diesel-engine Bolts, Hexagon-head Cap-screws, Stripper Bolts, Double-end Studs, and Fiber Insulator Rods have been Centerless Ground on the Threads by Employing the In-feed Method

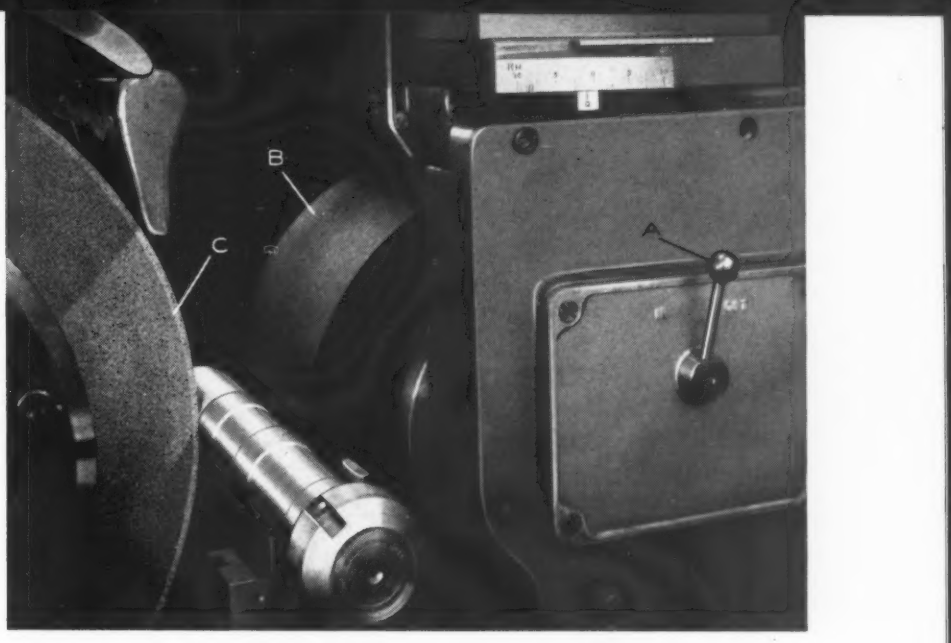


Fig. 4. With the In-feed Method of Centerless Thread Grinding, the Automatic Operation is Started by Moving the Lever A to the Left

to suit the truing of the 6-inch wide grinding wheels. The automatic grinding-wheel crushing device was also improved to permit crush-dressing of wider wheels so as to prepare them for coarser thread pitches. Improvements in the drive to the regulating wheel spindle, including an increase in the power of the driving motor, were also made to permit the grinding of large work-pieces and coarse-pitch threads.

The wider grinding wheels have decreased the working stresses on the abrasive grains in the wheels, and this has resulted in longer grinding periods between wheel dressings. The development of harder bonds for grinding wheels suitable for crush-dressing has permitted the use of higher work surface speeds, which, in many instances, has more than doubled the previous rates of production. With the wider grinding wheels and increased power to both the grinding and regulating wheels, the productive rate and economy of the centerless thread grinder compares favorably with thread cutting for many classes of work, and, in some cases, is faster and better than thread cutting.

Developments in the In-Feed Grinding Process

The in-feed method of centerless grinding is used in grinding threads on work-pieces having heads or shoulders, double-end studs, parts having one or more diameters larger than the diameter to be threaded, and parts requiring threads that must be concentric with another portion of the piece within close tolerances. This process is employed for grinding threads from the solid, as well as for finishing precut threads.

A group of parts ground by the in-feed process is shown in Fig. 3. These parts include Diesel-engine studs, hexagon-head cap-screws, stripper bolts, double-end studs, and fiber insulator rods. The threaded diameters of the parts range from 1/4 inch to 1 7/8 inches, and the number of threads from 12 to 20 per inch. All of the threads on the parts illustrated were ground from the solid. The threads on the stripper bolts and Diesel-engine studs are ground concentric with the bodies to close tolerances.

The versatility of the in-feed process is further illustrated by the fiber insulator, which is the third part from the left at top of the illustration. This part, having threads at both ends, of the same diameter, pitch, and hand, was completed in a single thread-grinding operation by using two grinding wheels spaced apart to give the required distance between the threaded sections. Within limited conditions, the same machine set-up can be used for grinding both right- and left-hand threads, it only being necessary to change from "up-grinding" to "down-grinding" by simply reversing the direction of work rotation.

The in-feed method of centerless thread grinding completes the entire length of thread in approximately 1 1/4 revolutions of the work-piece. This permits grinding threads very close to a shoulder with a minimum of imperfect thread or relief at the shoulder. Under most conditions, the relief or imperfect thread at the shoulder can be limited to the pitch of one thread.

This method of thread grinding does not incorporate means for grinding the outside diameter of the blank prior to generating the thread, as is generally the case in through-feed grinding. Hence it is necessary that the accuracy of the blanks be within the tolerances specified for the finished thread. That is, the variation in the diameter from one blank to another must not exceed the variations permitted in the pitch diameter of the finished threads.

If a thread is to be concentric with an unthreaded section of the part, the blank must be concentric prior to thread grinding within the

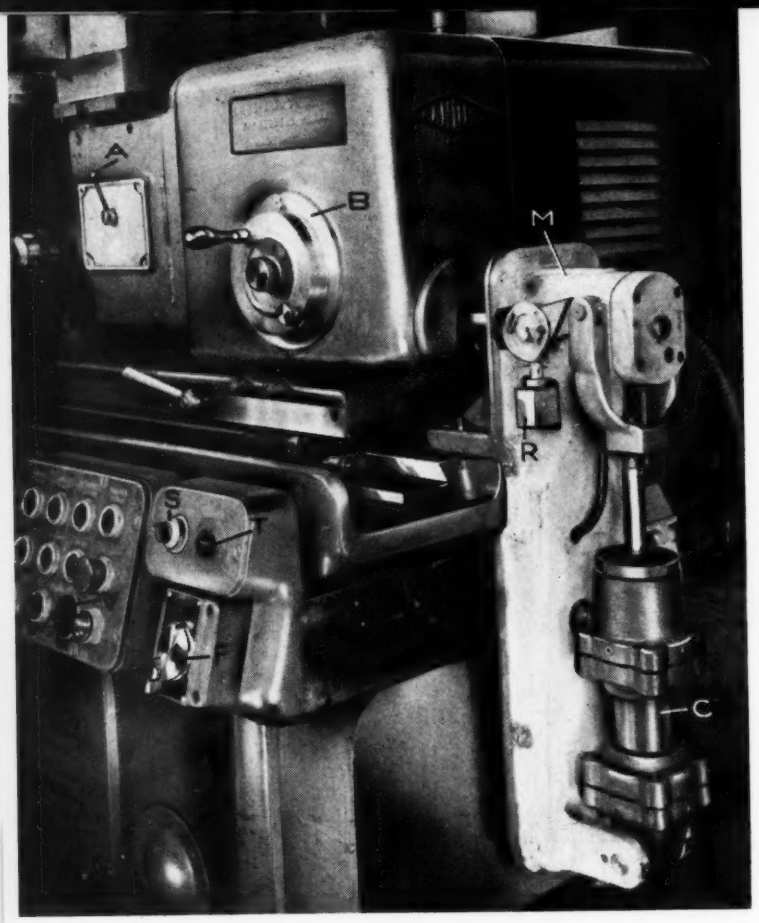


Fig. 5. Right-hand End of the No. 1 Centerless Thread Grinding Machine, Showing the Mechanism for Controlling the In-feed Cycle

same limits of concentricity as are required for the finished part. The majority of blanks produced on automatic screw machines can be thread-ground by the centerless in-feed process to required tolerances for pitch diameter, lead, and concentricity without an intermediate grinding operation. The accuracies obtained in some classes of cold-forged parts are frequently adequate for in-feed thread grinding.

The recent improvements made in the No. 1 centerless thread grinder for in-feed grinding include a new automatic work cycle, the use of the standard regulating wheels employed for through-feed grinding, a speed range for the regulating wheel ranging from 1/4 to 25 R.P.M. for grinding, and a high speed of 400 R.P.M. for dressing.

The in-feed cycle consists of placing a blank work-piece on the work-rest blade between the grinding and regulating wheels and moving the lever *A*, Fig. 4, to the left. The in-feed mechanism then automatically advances the work-rest, work-piece, and regulating wheel *B* toward the grinding wheel *C* at a rapid rate until the work comes in contact with the grinding wheel. The rotation of the regulating wheel is automatically started at this part of the cycle, and the in-feeding continues at a uniformly decelerating rate until the thread-generating ribs on the grinding wheel have penetrated the surface of the work-piece to the full depth of the thread.

At this point, a positive stop maintains the exact distance required between the grinding and regulating wheels while the work-piece continues to rotate to produce the complete thread. When the required rotation of the work-piece is completed, usually 1 1/4 revolutions, the in-feed mechanism automatically reverses to return the work-rest and regulating wheel to the starting position, and simultaneously stops the rotation of the regulating wheel. The finished work-piece can then be removed from the machine.

The mechanism for controlling the in-feed

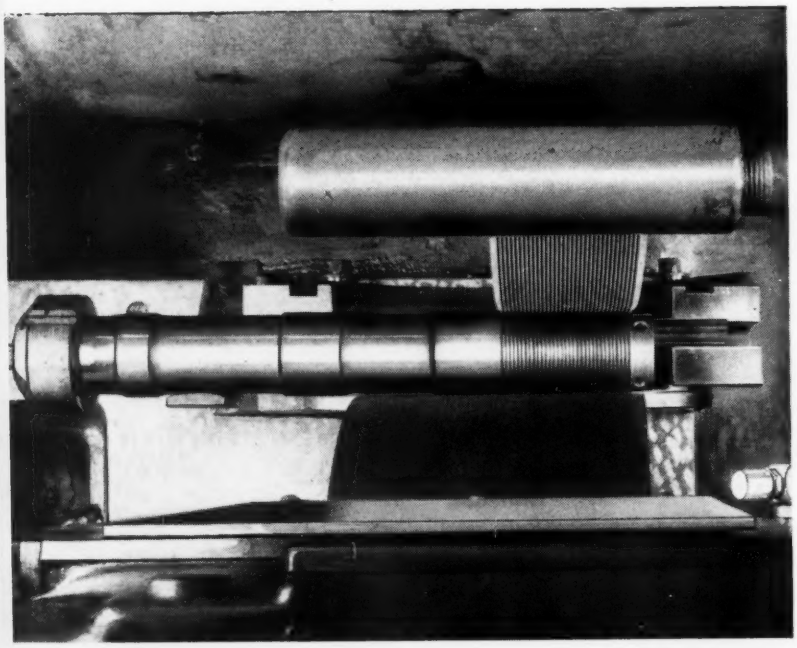


Fig. 6. View Looking down into Centerless Grinding Machine Throat, Showing Relationship between Grinding and Regulating Wheels in Grinding a Diesel-engine Bolt

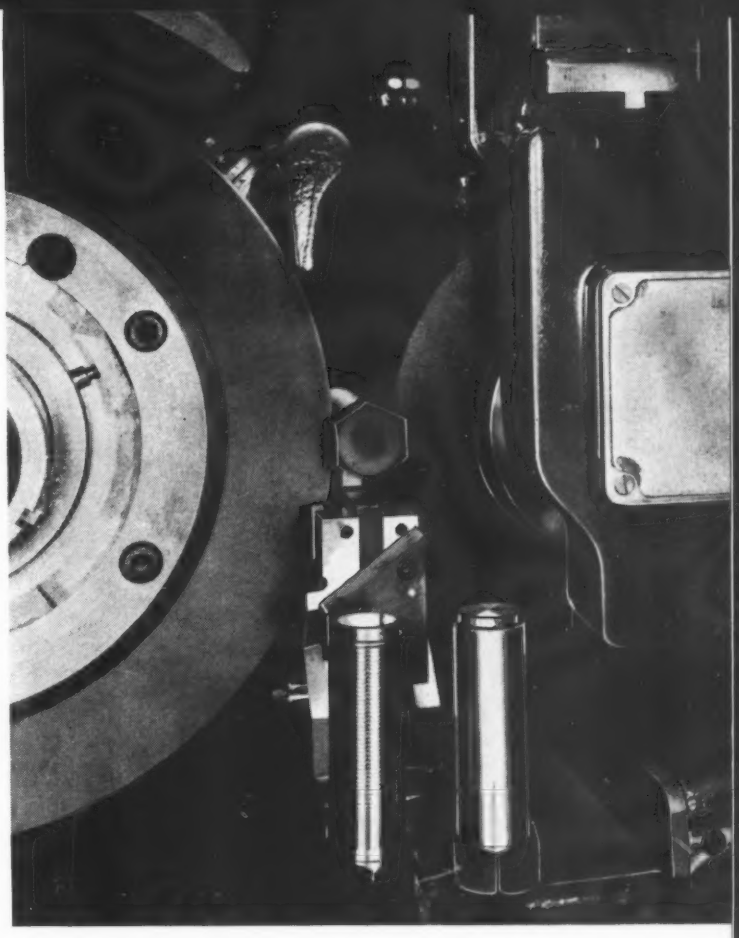


Fig. 7. Looking at the Front End of the Centerless Grinding Machine Set-up for In-feed Grinding of a Hexagon-head Stud

cycle is attached to the right-hand end of the machine bed, as shown in Fig. 5. The hydraulic cylinder *C* drives an eccentric mechanism *M*, which moves the machine slides as previously described. Switch *R* starts and stops the regulating wheel at the proper cycle intervals. Control knob *T* is used to select the cycle time to provide the required number of revolutions of the work-piece, and the adjustable valve *F* controls the feed rate of the machine slides. Knob *V* is used for adjusting the speed of the regulating wheel for in-feed and through-feed grinding.

Selector switch *S* is turned to the "on" position for in-feed grinding and to the "off" position for through-feed grinding. Lever *A*, when moved to the left, starts the in-feed cycle; if desired, the in-feed cycle can be stopped at any time by moving lever *A* to the right. The handwheel and dial *B* are used for adjusting the relationship between the grinding and regulating wheels to control the pitch diameter of the thread. The dial is graduated to read to 0.0001 inch on the work diameter, and is used to compensate for both grinding and regulating wheel wear.

Several typical in-feed grinding set-ups of the centerless thread grinder are illustrated in Figs. 4, 6, 7, and 8. Fig. 6 is a view looking down into the throat of the machine to show the relationship between the wheels and the work-piece in grinding a Diesel-engine bolt. A front view of the same set-up is shown in Fig. 4. A set-up for the in-feed grinding of a hexagon-head stud is illustrated in Fig. 7, and a top view of the same set-up is shown in Fig. 8.

"Up-Cutting" — A New Centerless Thread-Grinding Technique

A new technique in centerless thread grinding developed by the Landis Machine Co., for which a patent application has been filed, is that of "up-cutting" as contrasted with "down-cutting,"

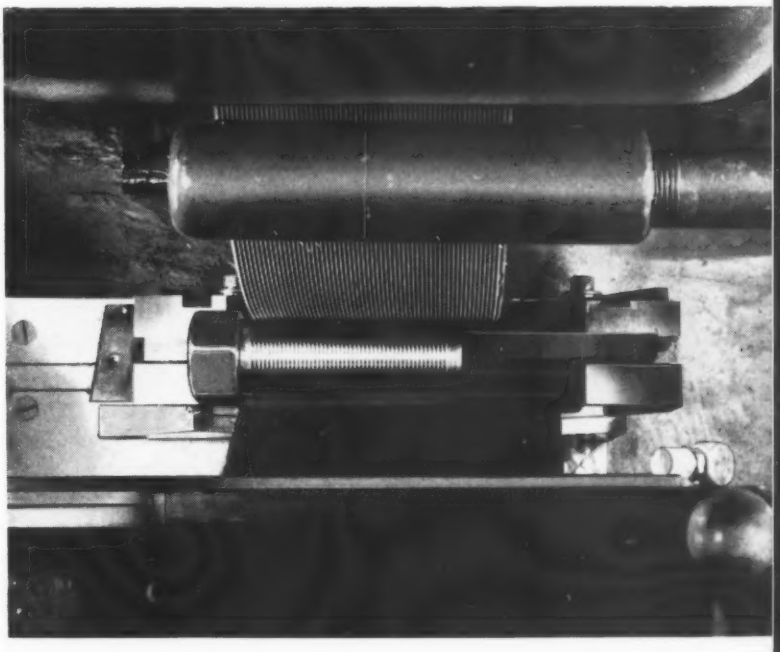


Fig. 8. View of the Hexagon-head Bolt Thread Grinding Operation Illustrated in Fig. 7, as Seen Looking down from the Top of the Centerless Grinding Machine

the practice heretofore. "Down-cutting" is illustrated diagrammatically in Fig. 9. With this method, the relationship of the work and grinding wheel rotation is the same as that generally used for centerless cylindrical grinding and, as that always used, until recently, for centerless thread grinding. The surfaces of the work-piece and grinding wheel move in the same direction at the point of contact. This condition imposes a high stress on the abrasive grains in the crests of the thread-generating ribs on the wheel.

In the "up-cutting" method, as indicated in Fig. 10, the work-piece is rotated in the same direction as the grinding wheel. Thus, the surfaces of the work-piece and the grinding wheel move in opposite directions at the point of contact. With this method, the stresses imposed at the crests of the ribs on the grinding wheel are greatly reduced, thus enabling the use of work surface speeds up to 30 per cent greater than for similar grinding conditions with "down-cutting"; also the periods between wheel dressings are increased.

Another advantage of this method is that all forces act downward toward the work-rest support blade. The work-piece is thus held firmly on the work-rest blade and the tendency to produce chatter marks under heavy cuts is reduced. Control of the work rotation and of its endwise travel in timed relation to its rotation is obtained solely by the regulating wheel, and is completely independent of friction between the grinding wheel and the work-piece. Spinning of the work is practically eliminated, especially in grinding coarse threads on heavy work-pieces. Generally, this new technique is used for in-feed grinding and for large work requiring coarse threads.

Making Plant Visitors Welcome

Those concerned with public relations problems may be interested in a method adopted by Scully-Jones & Co., of Chicago, to make visitors to their plant welcome. A special "welcome booklet" has been prepared for salesmen calling at the plant and other visitors. It contains an invitation to have refreshments without charge at the company cafeteria; a listing of the names of the personnel for whom visitors frequently call, together with the phonetic pronunciation of their names; a snapshot history of the company; and a list of the products made and the services bought. The booklet has been received with enthusiasm by salesmen calling on the company. A plan of this kind, or any other method of making visitors to a plant welcome, is often an important factor in building up good will.

* * *

New Officers of Aluminum Association

At the annual meeting of the Aluminum Association, held last January in New York City, the following officers were elected for the ensuing year: President, R. S. Reynolds, Jr., of the Reynolds Metals Co., Richmond, Va.; vice-presidents, E. G. Grundstrom, Advance Aluminum Castings Corporation, Chicago, Ill., M. E. Rosenthal, United Smelting and Aluminum Co., Inc., New Haven, Conn., and George N. Wright, John Harsch Bronze and Foundry Co., Cleveland, Ohio. Donald M. White was reappointed secretary and treasurer. The headquarters of the Association are at 420 Lexington Ave., New York 17, N. Y.

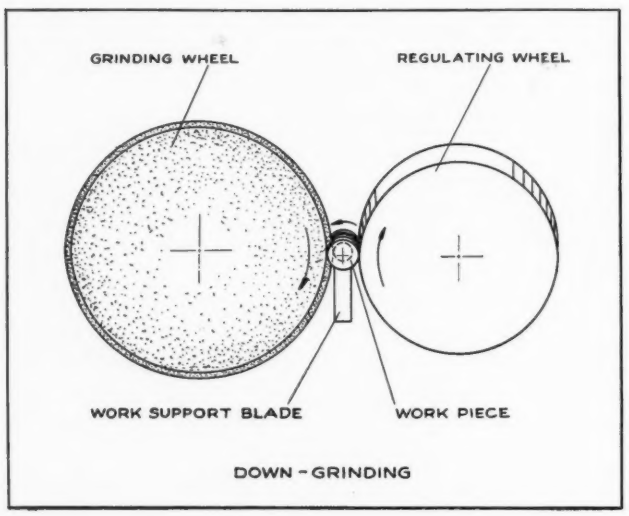


Fig. 9. Diagram Indicating the Rotational Direction of the Grinding Wheel, Regulating Wheel, and Work-piece in "Down-grinding"

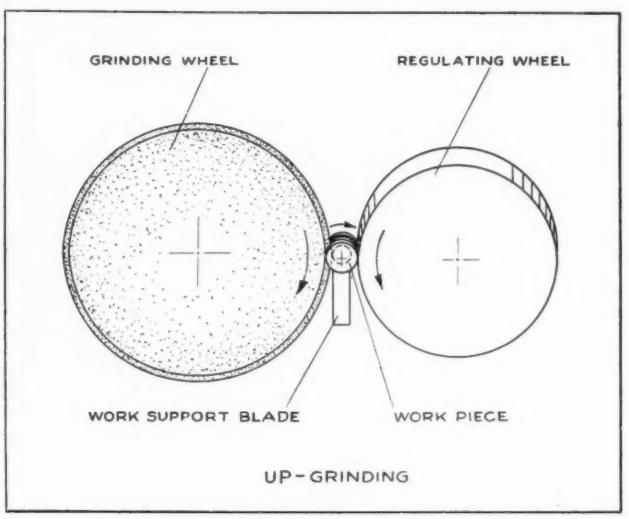


Fig. 10. Diagram Indicating the Rotational Direction of the Grinding Wheel, Regulating Wheel, and Work-piece in "Up-grinding"

Simplifying Manufacturing Methods with Air-Operated Fixtures

COMPRESSED air, intelligently applied, is an economical and efficient source of power for many of the automatic tools essential to high production in industry. Air-operated clamps, fixtures, presses, portable tools, and other devices are widely employed to increase production rates and reduce operating costs. Effective use of compressed air has been made in the plant of the Lewyt Corporation of Brooklyn, N. Y., where air-operated equipment is extensively employed in the production of household vacuum cleaners.

One of the air-operated fixtures used in this plant is shown in Fig. 1. In the operation illustrated, a groove, or bead, is rolled into the outer member of a tubing assembly to provide a retainer. The complete part, which is the swivel connection for a vacuum-cleaner hose nozzle, is shown in cross-section in Fig. 2.

Prior to the operation, the piece is partially assembled. A vinylite plastic tubing air seal is placed in an annular groove in the inner member, and grease is applied at the bearing section to reduce friction in swiveling, after which the outer tube, or cup, is assembled in place. The unit is then located on a ball-bearing mounted spindle which travels in a gib arrangement on the base of the fixture. The fixture is secured to the table of a drill press, the spindle of which drives the rotating beading disk. Operation of a foot-valve actuates an air cylinder that is attached to the fixture base, thus bringing the assembly into contact with the beading disk. The work rotates freely on the ball-bearing spindle, thus insuring beading of the entire circumference.

A micro-switch, actuated by the air-cylinder piston near the end of its stroke, operates a warning light on the spindle housing of the drill press when the beading is sufficiently deep. Free swiveling of the two tubing sections is provided for by the beading which is aligned with an annular groove in the inner member and holds the entire assembly together. With this equip-

Fig. 1. A Single-acting Air Cylinder, Controlled by a Foot-valve, Brings the Work into Contact with a Rotating Disk for Performing a Beading Operation. The Operator is Free to Pre-assemble, Load, and Unload the Work

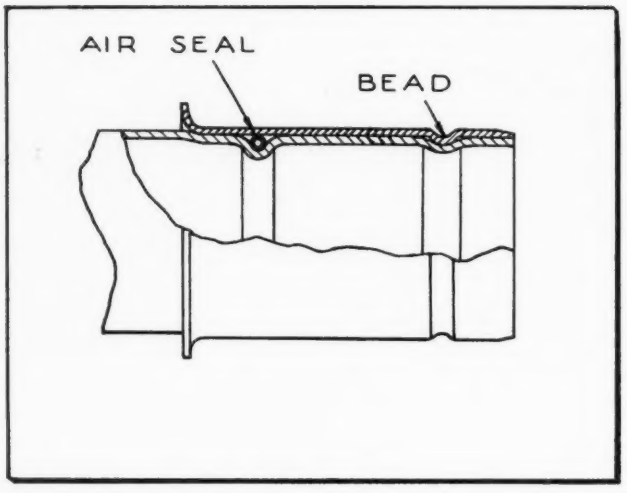


Fig. 2. Cross-sectional Diagram of a Vacuum-cleaner Hose-nozzle Swivel Connection which is Assembled and Beaded at the Rate of 300 Units per Hour

ment, which leaves the operator's hands free for pre-assembling, loading, and unloading, a production of 300 assemblies per hour is attained.

An air-operated fixture of interesting design is used to produce the cover gasket reinforcing wire for vacuum cleaners in two operations. This part is made of 0.011-inch diameter music wire and is formed as shown in Fig. 3. The fixture, illustrated in Fig. 4, uses two single-acting air cylinders.

A feed-roll holds the wire under spring pressure by means of a tensioning device which prevents unravelling of the wire when it is fed to the fixture. Using guides on the fixture, the operator winds an end of the wire around a forming block in an S shape, as indicated by phantom lines at the right in Fig. 3. He then actuates a foot-valve which controls an air cylinder that moves the forming punch into the operating position, adjacent to the forming block, thus setting the two loops of the S.

There is an opening between the forming punch and block when they are in the operating position, which permits access to the wire for cutting the S shape at the center. Cutting through the center forms two loops, one of which is the front end of the succeeding length of wire and is to be twisted as shown at the left in Fig. 3. The other loop, which remains open, is of sufficient length to provide a hook for assembly with the twisted end after the wire is inserted in the gasket tube.

When the operator feeds the succeeding length of wire to the forming station, he engages the loop previously formed with the twisting arm, shown at the left in the illustration. Here the wire is held in place by a rubber-loaded toggle clamp. Rotary motion of the arm for imparting a twist to the wire is obtained by a pinion actuated by an air-cylinder driven rack. An exact, predetermined number of turns is obtained, insuring uniformity in the length of the part. Both the twisting and looping operations are performed simultaneously, inasmuch as the two air cylinders are controlled by one foot-valve. The operation just described is performed by a blind operator who, by the use of this fixture, easily forms 180 to 200 gaskets per hour, including assembly with a rubber tube.

Many other sub-assembly operations are performed by the aid of air-operated devices. Among these is the operation illustrated in Fig. 5, where three air cylinders are employed to operate clamps for holding a filter bag and a supporting wire ring in position while forming one of the three types of filters used in the cleaner made by this company. In this application, two foot-valves are used to control the air cylinders. One actuates the rear cylinder, and the other the two cylinders on the sides.

Filter bags are received with a wire sewn into the outside edge and the ends of the wire projecting. The retainer ring is put on a locating boss on the fixture and the filter bag is placed over it with the projecting ends of the wire extending toward the operator. The rear clamp is actuated to hold the assembly in this position while the operator feeds the outer edge of the bag, containing the wire, into a recess extending around the circumference of the retainer ring. When the seating of the bag in the recess has progressed as far as the two side clamps, these clamps are actuated to hold the assembly, permitting the operator to finish seating the bag and to complete the assembly process by twisting the ends of the wire together.

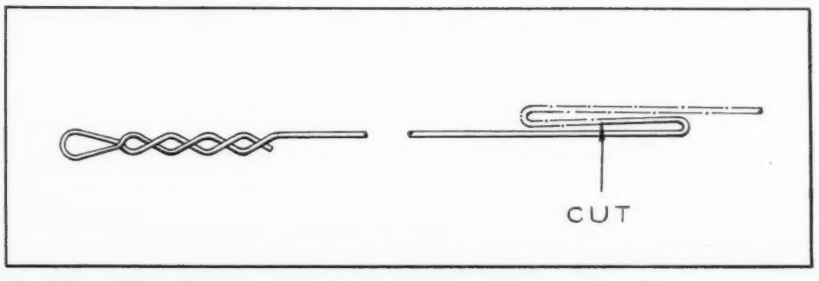


Fig. 3. Music Wire Gasket Retainer, which is Twisted at One End and Looped at the Opposite End for Hooking Together to Form a Circular Gasket after Assembly in a Rubber Tube

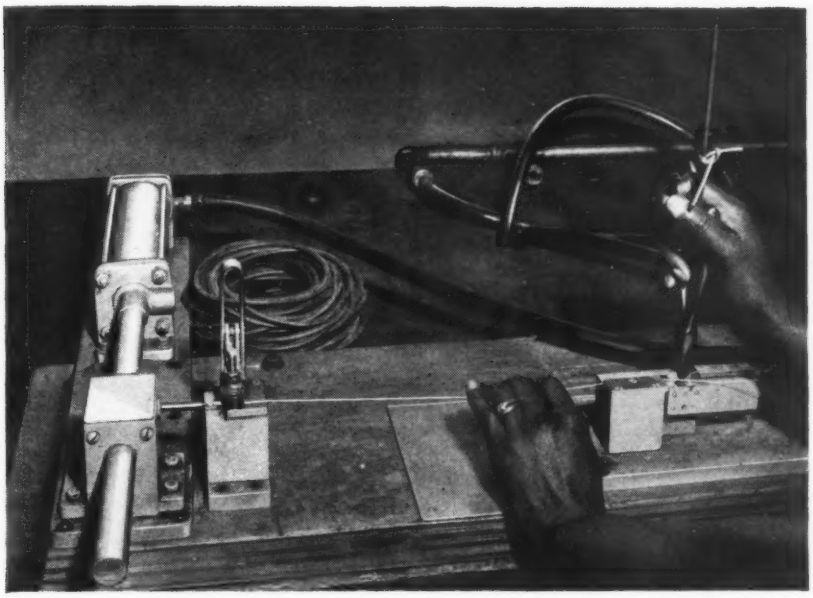


Fig. 4. Fixture Utilizing Two Air Cylinders, Controlled by a Foot-valve, Employed in Forming and Twisting Wire Gasket Retainer Shown in Fig. 3

One of the simpler, but nonetheless efficient, uses of compressed air in this plant is the use of an air-operated press to compress filter material in the metal top of the vacuum cleaner. This application is shown in the heading illustration.

Among the many air-operated tools and equipment used to simplify manufacturing methods are fixtures for inserting brass ferrules in the ends of small-diameter vinyl plastic tubes; presses for crimping lugs on motor switch and terminal assemblies; and tools for installing snap-fastener parts in vinylite plastic straps.

Another process that makes extensive use of air power is the spray painting of vacuum cleaner parts. The water-wash spray booth shown in Fig. 6 contains a solenoid-operated air valve between the compressed-air line and the spray guns. The valve is actuated by current from the motor starter of a blower, so that the blower must be in operation before spraying can be started. The water-curtain pump is also interlocked to the spraying system by the same valve. The necessity of starting the blower and water-curtain pump before the spray guns can be operated insures complete protection from the paint fumes. The water curtain carries the paint over-spray into a tank, where an air draft from the blower removes the paint particles. A detergent in the water facilitates coagulation of the paint for easy removal from the tank.

Included among other air-operated devices in use at the spray booth are agitators in the paint tanks which keep the paint in suspension and at the proper viscosity. Air pressure also provides the spray velocity of the guns, which is controlled by valves that are set to suit the requirements of the job being handled.

From the foregoing it can be seen that compressed air is an important factor in maintaining high production rates in this plant. To supply compressed-air requirements to various sections of the plant, air compressors have been installed in strategic locations rather than in a single compressor room. However, all the compressors are connected to a single air system, which produces a steady supply of air throughout the plant at 90 pounds pressure.

In order to gain the maximum benefits of air-

Fig. 5. Filter Bags are Assembled to Retainer Rings by the Use of an Air-operated Fixture

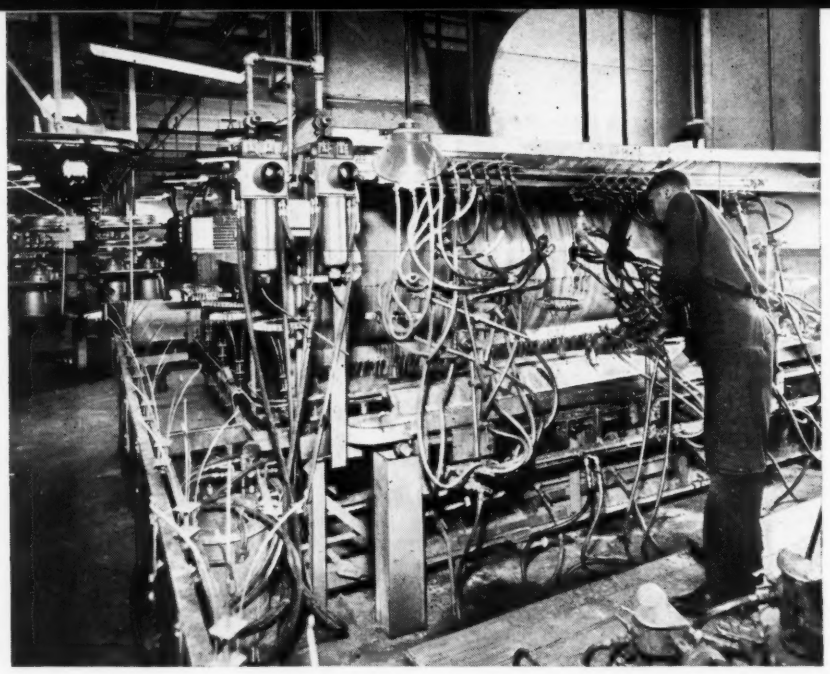


Fig. 6. Water-wash Spray Booth for Painting Vacuum-cleaner Parts Makes Extensive Use of Air-operated Devices

operated tools, careful planning of a compressed-air distribution system is necessary. The selection and installation of equipment are of prime importance. Pressure losses, which reduce the ability of a tool or fixture to do the work for which it was designed must be guarded against. Among the most common causes of low pressure are line leaks, increased use of air without a corresponding expansion of the system, and inadequate piping. With ordinary care in installing and maintaining a compressed-air system, however, these causes can be eliminated.

Tool Control System Made Available by Carboloy Co.

TO assist manufacturers in metal-working industries to achieve lower costs without any expenditures for capital equipment, the Carboloy Company, Inc., Detroit, Mich., has developed a coordinated tool control plan. This plan is the result of several years of research and fact-finding in industry.

Advantages said to be derived from the application of the plan are as follows: Less machine "down time" for tool changes; reduced grinding costs through centralized grinding facilities with proper equipment, techniques, and training; widest possible utilization of lower-cost standard tools; better tool-holding devices; reduced tool inventories through effective inventory maintenance; elimination of bottlenecks and provision of efficient trouble-shooting service on tooling; improved tool control through proper training of supervisors, tool grinders, designers, etc.; greater economy in tool requisitioning; better machine conditions for effective tool utilization; lower tool fabrication costs, where manufacturers make their own tools; longer tool life and reduced tool spoilage; reduced scrap due to tools; and reduced number of machines required for a given output.

In general, the Carboloy program of tool control is of such a nature that it can be applied by individual manufacturers. To make this possible, a considerable number of aids are available which include (1) a manual of tested cost-reducing tool control systems and practices with actual examples of their application in different types of metal-working plants; (2) a training course that includes six slide films (also reproduced in booklet form) for "in plant" training of personnel; and (3) a 200-page tool manual dealing with technical phases of tooling.

In addition, the entire Carboloy field organization, including district and branch office sales and engineering personnel, as well as tool engineers connected with distributors, is being made available as a consulting organization. The Carboloy training school for tool supervisors is also scheduled to serve as an effective link in training key personnel for individual companies.

The Carboloy Company reports that in a mid-western engine plant a reduction in tool and fixture inventory from $3,000,000 to less than $700,000 was achieved by a program of standardization under a tool control plan. A relatively small plant recovered $14,000 worth of excess tools scattered around the plant. Savings in manufacturing costs through tool control can be achieved under the program, regardless of the types of cutting tools used.

Densified Wood Applied to Metal-Working Operations

Fig. 1. A Densified-wood Pattern Board is Seen at the Right behind the Top Mold. The Bottom Mold is Seen at the Left

DENSIFIED wood impregnated with Bakelite phenolic resin is a relatively new material that is harder than any solid wood, and yet lighter than any solid metal. This material is being applied in a variety of ways in the metal-working industries. Dimensional stability, toughness, high strength, and durability are some of its outstanding advantages. It is resistant to water, chemicals, abrasion, scuffing, and extremes of temperature, and can be easily machined with conventional tools.

The Bakelite phenolic resin transforms the porous, water-absorbent wood into a hard water-resistant material. Almost any kind of wood can be impregnated with this resin. The most practical method of producing laminated densified wood is by the assembly of impregnated veneers. Thin veneers, 1/16 inch or less, are impregnated by applying the undiluted resin as a surface coating, using a conventional glue spreader. The resin is forced into the wood during subsequent compression. Another method, more widely used than spreading, consists of immersing the veneers in a water solution of the

Fig. 2. Cast-iron Gear Blanks Produced from the Pattern and Mold Illustrated in Fig. 1, and the Finish-machined Gears

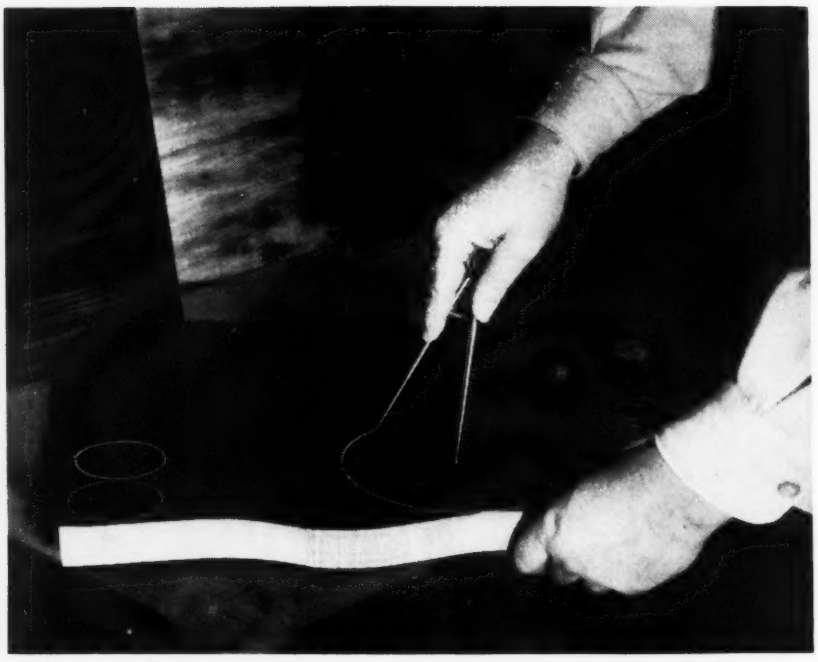


Fig. 3. Densified-wood Pattern Material Can be Scribed with Ordinary Tools, No Surface Preparation being Required

resin. During compression, the laminated assembly is reduced to approximately 50 per cent of its original thickness, depending on the pressures used.

A densified wood known as "Sag-U-Mat," which is distributed by the Pioneer Foundry & Mfg. Co., Gilbertville, Mass., is available in sheet form for pattern material and parting boards used in foundry casting operations. Sheets 30 inches wide by 48 inches long and from 1/2 inch to 2 inches thick, varying by increments of 1/8 inch, are produced. A pattern for casting metal gear blanks, such as shown in Fig. 1, can be constructed from densified wood material for about one-third the cost of a segmental wood pattern.

This pattern was completely finished, starting with sheets of the densified wood, in 2 1/2 hours. If the same pattern were made completely from aluminum, it would require about twenty hours to produce a master pattern and approximately seventy-two hours to cast an aluminum pattern, making a total of ninety-two hours. If the pattern were made from carefully selected wood, segmentally constructed to minimize dimensional changes, about twenty-four hours would be required—twelve hours for manufacturing, and another twelve for the glue to set and the shellac to dry. Cast-iron gear blanks produced from the densified wood pattern and the finish-machined gears are shown in Fig. 2.

Patterns made from densified wood are durable, permanent, and undergo a minimum amount of dimensional change. Pattern maintenance costs are reduced, and long life is obtained.

In making patterns, the densified wood is machined on conventional wood- and metal-working machine tools at surface speeds up to 1500 feet per minute. After selecting and measuring the material, the

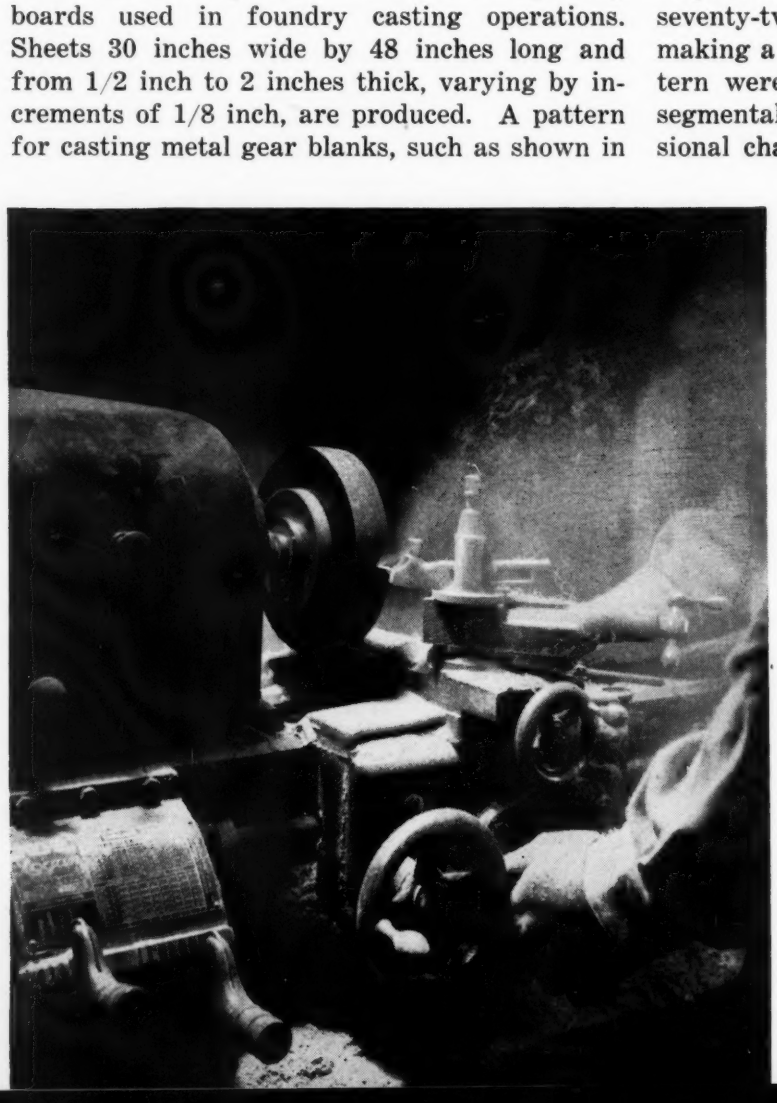


Fig. 4. Densified Wood is Machined on Conventional Machine Tools at Surface Speeds up to 1500 Feet per Minute

Fig. 5. Webs are Routed in a Densified-wood Parting Board by Means of an Attachment Mounted on a Drilling Machine

sheets can be scribed with ordinary tools, as seen in Fig. 3, no preparation of the surface being required. The centers of the scribed blanks are drilled and tapped, and then the blanks are cut from the sheet stock by means of a band saw.

The web and outside diameter of the wood blank are turned after screwing the blank on the lathe stud (see Fig. 4). Webs are routed in the parting boards by means of a special routing attachment mounted on the spindle of a drilling machine, as seen in Fig. 5. Machining will not destroy the smooth, hard surface finish of the densified wood. A high gloss can be restored to any portion of the surface by buffing.

Successful machining of densified wood depends primarily upon keeping the tools sharp. For straight sawing cuts, a band saw 1 inch wide is most desirable, while for scroll work, a 1/4-inch wide saw should be used. The band saw should have about 5 1/2 points per inch and a thickness of 19 gage (0.042 inch), and should operate at approximately 4000 linear feet per minute. Turning tools should be ground to a diamond point, with plenty of clearance and with from 3 to 5 degrees more rake than is commonly used for cutting metal.

High-carbon steel drills should be used without lubricant. Since a hole drilled in densified wood will be a little under size, the drill should be ground slightly off center to obtain a hole of the same diameter as the drill. Frequent sharpening is necessary. Ordinary taps and dies are suitable, using lubricant the same as when operating on metal.

Chucks for spinning aluminum parts can be machined from densified wood for about one-sixth the cost of similar forming dies made of metal. Densified-wood chucks have a low coefficient of friction, which prevents overheating of the metal being worked. Also, such chucks will not scratch the aluminum part.

Densified wood is being employed by the aircraft industry in making punches and dies for forming aluminum. Large punches, approximately 5 feet long by 4 feet wide by 16 inches deep, have been produced for drawing aluminum with a reduction in tool costs of about 10 per cent. The wood dies can be easily modified to take care of changes in product design by inserting patches in the die to alter its contour. Again, because of the low coefficient of friction of the densified wood, splitting or tearing of the drawn aluminum parts at the corners is reduced to a minimum.

The average properties of a typical grade of densified wood are indicated in the accompanying table. The strength of any grade of densified wood can be changed by varying the grain direction of the laminations. The tensile strength varies from 14,000 pounds per square inch for cross-grain laminations to 30,000 pounds per square inch for parallel-grain laminations.

Average Properties of a Typical Grade of Densified Wood

Specific Gravity	1.35
Rockwell Hardness (S Scale)	110
Modulus of Rupture,* Pounds per Square Inch	49,000
Modulus of Elasticity, Pounds per Square Inch	4,300,000
Compressive Strength,* Pounds per Square Inch	28,000
Shear Strength, Maximum, Pounds per Square Inch	3400
Izod Impact Strength, Foot-Pounds per Inch	8

*Parallel to the grain and laminations.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New Line of Hard-Facing Alloys Announced by Airco

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., has announced a new line of fifteen Airco hard-facing alloys, which are divided into three primary groups—ferrous alloys, cobalt-base alloys, and tungsten carbides. One of these hard-facing alloys, designated "Aircolite," is especially recommended for equipment subjected to severe abrasion and medium impact, such as pulverizer hammers and core crusher rolls. It can be applied with an oxy-acetylene torch or an electric arc. Another of these alloys, known as Airco "self-hardening" alloy, is for equipment subjected to severe impact and abrasion, such as bucket teeth and sizing screens. It is applied by the use of an electric arc. 201

Synthetic-Resin Coating Tape for Insulating Plating Racks

An improved orange-colored synthetic-resin tape for insulating plating racks has been brought out by the Hanson-Van Winkle-Munning Co., Matawan, N. J. This tape, called "Wrap-Rax," is effective as a "stop-off" in hard-chromium and other plating solutions. It chemically resists all cleaning, pickling, and plating solutions commonly used, prevents disintegration of the plating racks, and cuts current and metal losses to a minimum. 202

Rayon and Nylon Fabric Belt that Operates at High Tension

For conveyor applications where belt tensions run as high as 1000 pounds per inch of width, a new high-tension fabric belt has been placed on the market, by the Hewitt Rubber Division, Hewitt-Robins Inc., Buffalo, N. Y. The woven fabric is called "Raynile" because of its combination of rayon and nylon. Important features of the new belt include maximum tensions almost double that offered by 48-ounce cotton fabric; excellent transverse flexibility, assured by the nylon transverse threads; minimum stretch in actual operation; and field splicing made easy because of fabric construction.

Reinforcement of Raynile fabric belts is accomplished by the use of plies of rayon and nylon fabric suitably bonded to each other. The top cover is securely bonded to the body by a shock absorbing and distributing cord breaker....203

Water-Emulsion Wax Forms Rust-Inhibiting Coating

A water-emulsion wax known as rust-inhibiting wax No. 1568 has been developed for use as a coating for metals by S. C. Johnson & Son, Inc., Racine, Wis. It is applied by conventional dipping, spraying, wiping, or flow-coating, and forms a dry wax coating on the metal part that checks corrosion. It is non-flammable and non-toxic, and gives a coverage of between 2500 and 3000 square feet per gallon.

The new wax is being used as a corrosion inhibitor on black-oxidized, phosphated, and untreated metal surfaces, as well as on painted and plated parts as a safeguard against scarring and chipping. 204

Liquid Detergent for Automotive and Aircraft Uses

The Automotive and Aviation Service Division of Detrex Corporation, Detroit 32, Mich., has announced a liquid detergent for removing dirt, grease, and grime from automobiles, trucks, cars, etc., and aircraft. It is also said to be an excellent general-purpose cleaner.

This cleaning compound, designated "Drex Foam," has unusually effective cleaning and wetting properties; leaves no streaks, smears, or other blemishes on fine finishes or waxed and polished surfaces; and contains no abrasives or harsh alkalies that would scratch or dull surfaces or attack the skin of the user. 205

New Compound for Salvaging Rejected Porous Metal Castings

Castings rejected because of porosity can be salvaged in many cases by the use of a new compound known as Sealant P.E. No. 1. This compound, developed by the Western Sealant Co., 9093 W. Washington Blvd., Culver City, Calif., is intended primarily for the impregnation of low-density metals, such as aluminum and magnesium alloys. It can also be used successfully for impregnating bronze, steel, and gray-iron castings. Its application is clean, there being no gummy residue, and surfaces, ducts, pockets, or machined areas show no visible sign of the treatment. Operations such as anodizing or plating can be performed either before or after impregnation. Pressure-tightness can usually be obtained with only one impregnation. 206

Nylon Plastic Eliminates Need for Lubrication

A textile machine part made from nylon plastic which eliminates the need for lubrication when operating at speeds as high as 15,000 R.P.M. is being manufactured by the M. J. McHale Co., of Scranton, Pa. The nylon machine part is a flyer block, which is part of the flyer used in the twisting of yarn to guide the yarn being unreeled from a spool and keep it under tension so that it will not tangle. Flyer blocks formerly used required lubrication on the spindle, and the whirling of the flyer at 8,000 to 15,000 R.P.M. tended to throw oil on the yarn. The fact that the nylon block requires no lubrication eliminates this cause of yarn spoilage.

Nylon plastic, made by E. I. du Pont de Nemours & Co., Wilmington, Del., requires no lubrication under light loads and high speeds—as in this instance—or under moderate loads at low speeds. When lubricants are necessary, either oil or water may be used. 207

Solvent that Keeps Hydraulic Systems Clear

"Hydro-Solv A"—a liquid concentrate for use in hydraulic oil systems has been developed by the Swan-Finch Oil Corporation, R.C.A. Building West, New York 20, N. Y. This compound, which is composed of several highly active gum and sludge solvents, makes unnecessary the draining, flushing, and cleaning of a contaminated hydraulic system. A small percentage of the solvent added to the used oil carries into suspension or solution those contaminants which cause corrosion or interfere with efficient operation. 208

Silicated Marking Paint with High Wear Resistance

A silicated marking paint, many times as durable and resistant to continual cleaning as ordinary traffic paint and designed for industrial marking off of safety, storage, and traffic areas, is being manufactured by the Wilbur & Williams Co., Greenleaf and Leon Sts., Boston 15, Mass. The high silica content of this paint makes it non-slippery and reduces the dangers of skidding accidents. It can be applied equally well with brush or line markers. 209

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in March, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME..... POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY..... STATE.....

Spline Broaching Facilitated by Using Special Indexing Fixture

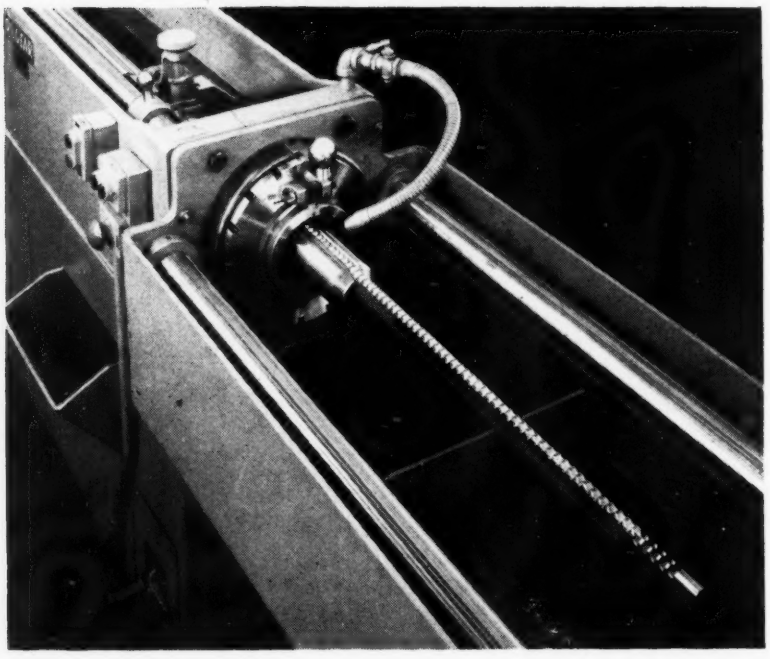


Fig. 1. Horizontal Broaching Machine Equipped with an Indexing Fixture to Facilitate the Broaching of Involute or Straight Splines in Chain Sprockets by Means of Simple Keyway Type Broaches

INVOLUTE and straight splines are broached in steel chain sprockets with simple keyway type tools in an Oilgear horizontal broaching machine equipped with the indexing fixture shown in Fig. 1. Sprockets with up to sixteen involute splines are broached. The sprocket is clamped to a split ring on the indexing plate, which has sixteen indexing notches.

After each pass of the broach, the indexing plate and the part are indexed simultaneously and locked in place by means of a lever. Close spacing of the splines is possible because any indexing error does not accumulate. One pass each of two form tools is required to finish each spline. Sprockets with involute and straight splines are shown at the left and right, respectively, in the line illustration, Fig. 2.

Starrett Precision Measuring Film

A sound film entitled "The Tools and Rules for Precision Measuring," prepared by the L. S. Starrett Co., illustrates, briefly, the development of precision measuring methods and standards, and shows many modern applications of the most widely used precision measuring tools. Instructions for reading the micrometer and vernier are also presented. This 16-millimeter film, which runs thirty minutes, is intended for use in vocational and industrial shop classes, for training purposes before groups of shop executives and mechanics, and for supplying salesmen with essential information on precision tools. Free showings can be arranged through the L. S. Starrett Co., Athol, Mass.

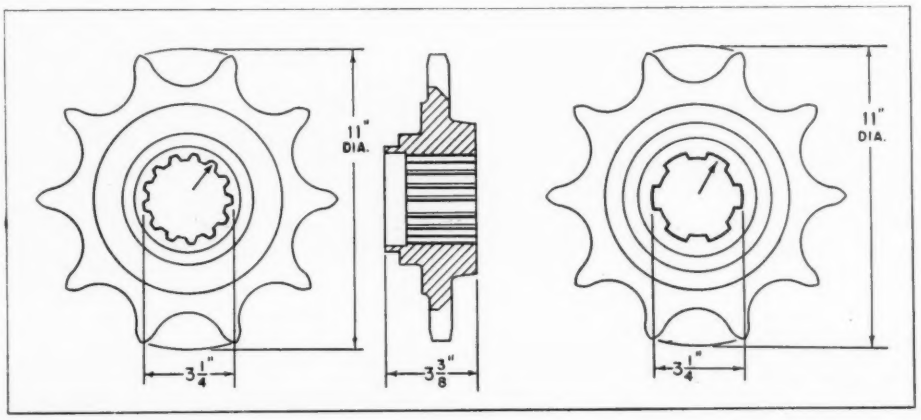
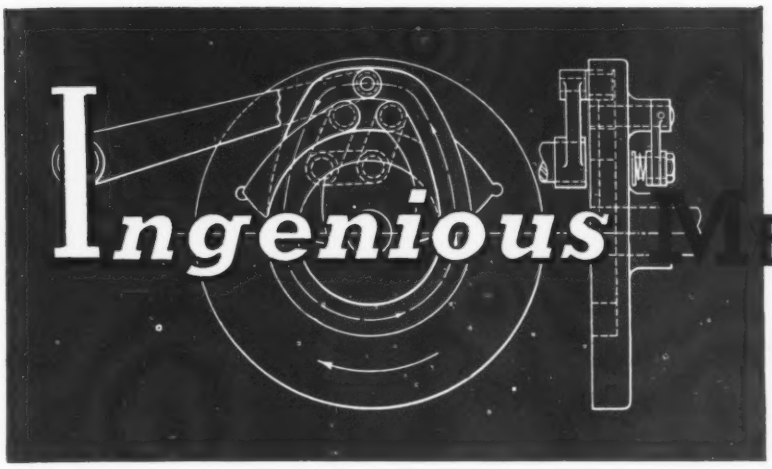


Fig. 2. Sketches of Typical Chain Sprockets in which Involute or Straight Splines are Broached by Employing Simple Keyway Type Broaches and an Indexing Fixture



Ingenious MECHANISMS

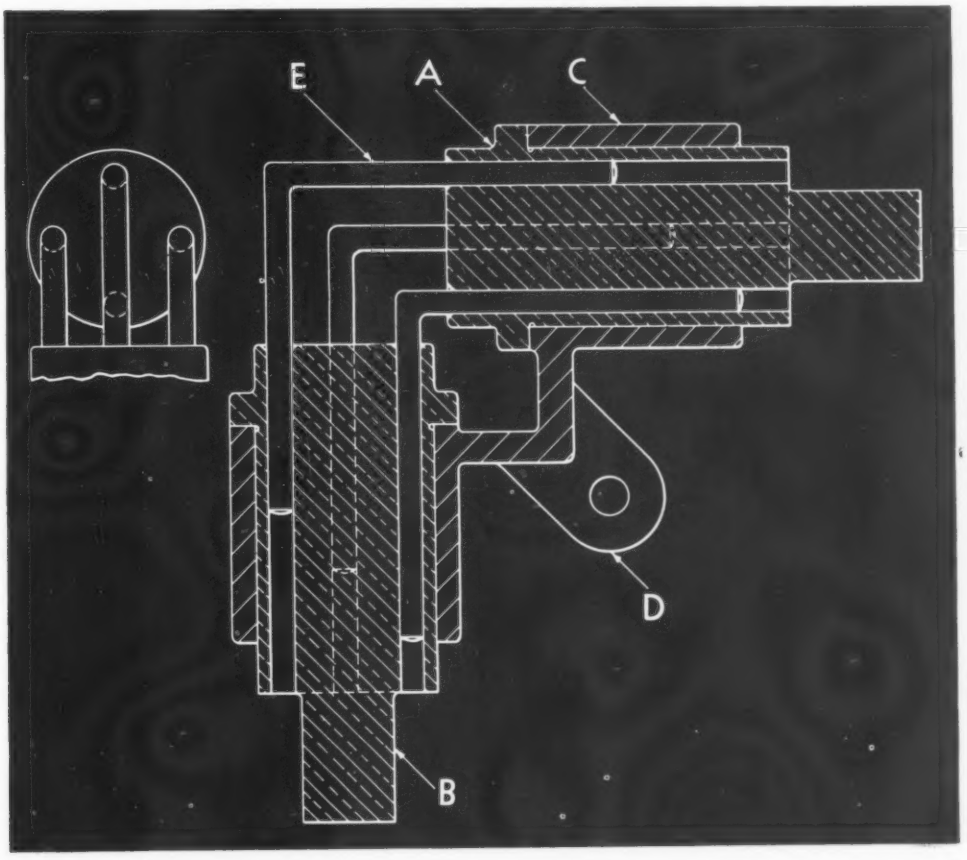
Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Right-Angle Drive for Rotary Motion without Backlash

By EDWIN MOSTHAF, Consulting Engineer

Some years ago, the writer designed the mechanism here illustrated to transmit rotary motion through two shafts at right angles to each other in the drive of a speedometer cable. For applications where power is not a major requirement, its principal advantages are elimination of backlash and uniformity of speed transmission between the driving and driven members.

Two rotating bushings *A* and *B* are assembled at right angles to each other in a supporting housing *C*. These rotating members are made a close running fit in their seats in the housing to insure smooth operation. Where conditions warrant it, ball bearings may be used to provide for free rotary movement. The supporting housing has a bracket *D* which permits adjustment of the right-angle drive to any desired plane. Four hardened shafts *E*, of equal length, are formed accurately to a right-angle bend and are inserted in lapped holes in the bushings. It can be seen that the depth of their engagement in the holes depends upon their respective positions on the hole circle.



Cross-sectional View of a Right-angle Drive for Rotary motion without Backlash

The shafts are free to move in a piston-like manner as the bushings revolve. Driving either bushing imparts a radial movement in the direction of rotation to the portion of the shafts assembled in the driving bushing. As the shafts rotate, an angular force is transmitted to the portion of the shafts assembled in the driven bushing, tending to move them in a radial path also.

The radial and angular forces originating in the driving unit act upon the driving and driven ends of the shafts, respectively, in such a way as to cause a rotary motion of the driven bushing. Inasmuch as both ends of the shafts are free to act in a reciprocating manner in their respective holes, it is possible for the driven shafts to follow the radial path resulting from the angular force and thus drive the bushing. The efficiency of angular velocity is increased and backlash is reduced to a minimum by the piston fit between the shafts and their holes.

[This device embodies the principle of a mechanism illustrated diagrammatically in Volume II of "Ingenious Mechanisms for Designers and Inventors," published by THE INDUSTRIAL PRESS —EDITOR.]

* * *

Approximately 20,000 tons of steel are used every year in making license plates for automobiles and trucks.

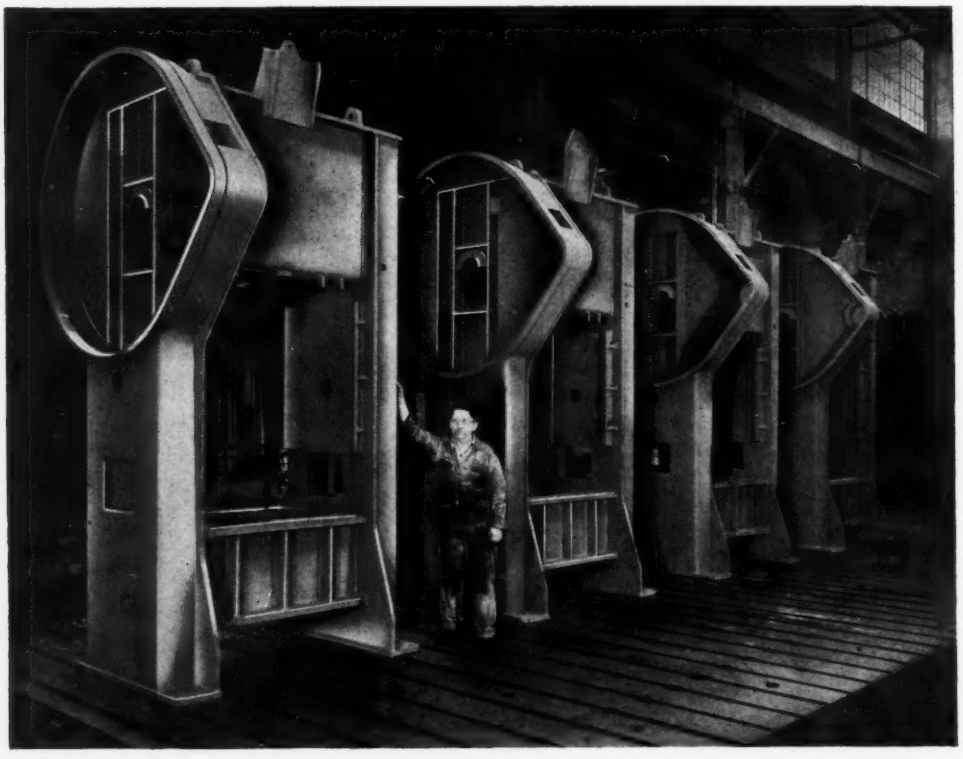
New Helium Liquefier for Low-Temperature Research

An improved type of helium liquefier developed by the National Bureau of Standards is proving very useful in a program of basic research on the properties of matter at extremely low temperatures, where many remarkable phenomena occur. An important feature of the new liquefier, resulting in greatly increased versatility, is a transfer siphon for delivering the liquid helium to an external receiver which can be easily modified to suit the experiment at hand.

The heart of the apparatus is a thick-walled Monel chamber, designed to withstand a pressure of 4100 pounds per square inch, within which the helium is liquefied. This chamber, together with an outer jacket containing pumped liquid hydrogen, is supported in an evacuated container by a tube of low conductivity, also used for filling and pumping the hydrogen jacket. The evacuated container is surrounded by liquid hydrogen in a sealed Dewar flask, which, in turn, is immersed in a similar flask of liquid air.

* * *

Producers of malleable iron castings spent more than $12,000,000 in 1948 for new machinery and equipment intended for the improvement and modernization of malleable foundries.



Four Vertical Press Frames of Welded Steel Construction Recently Fabricated by the R. C. Mahon Co.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

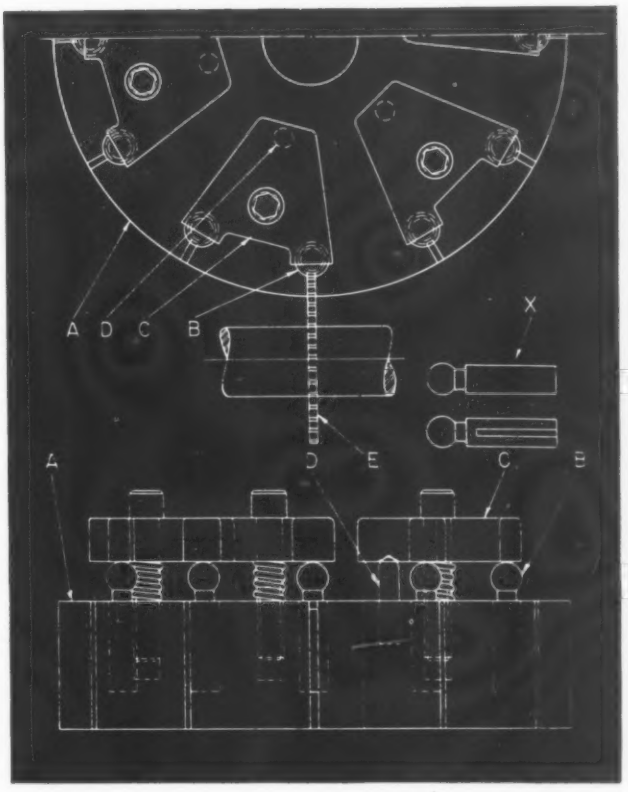
Fixtures for Milling Drill-Chuck Jaws

By HAROLD E. MURPHEY, Westerly, R. I.

The round head and neck of drill-chuck jaws are generally machined with form tools on automatic screw machines. The milling fixtures here illustrated were designed for the subsequent operations required to provide a keyway in the shank and flats on the round head of each jaw.

Keyways are milled in the round shanks of the jaws by the use of the fixture seen in Fig. 1. The cast-iron body *A* is drilled and reamed to hold twelve of the jaws *B*. Only half of the fixture is shown in the plan view, since it is symmetrical about the center line.

Six clamps *C* are provided, each of which holds down two parts. One end of each clamp is spot-drilled to rest on pins *D*, which are a drive fit in the body of the fixture. These pins have rounded tops, thus permitting the clamps to swivel slightly in order to compensate for any variation in the length of the jaws. Springs beneath each clamp and socket-head cap-screws are provided for loading and unloading.



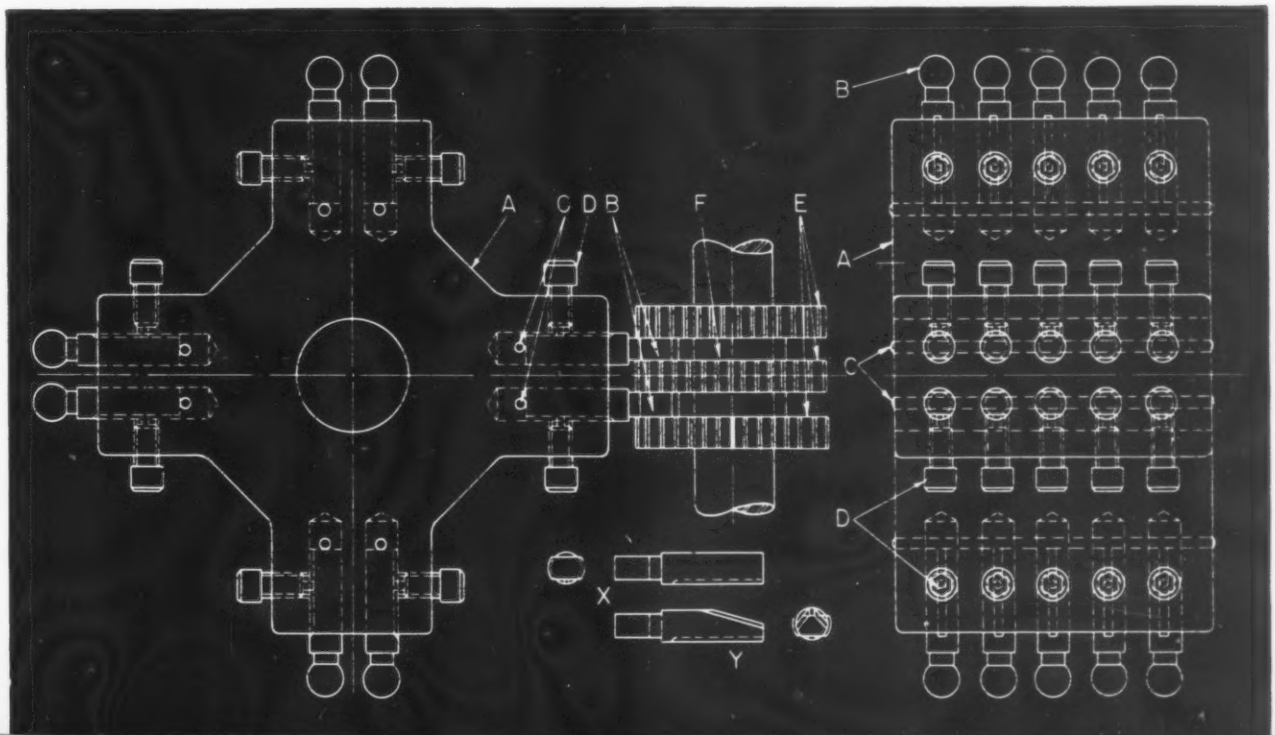


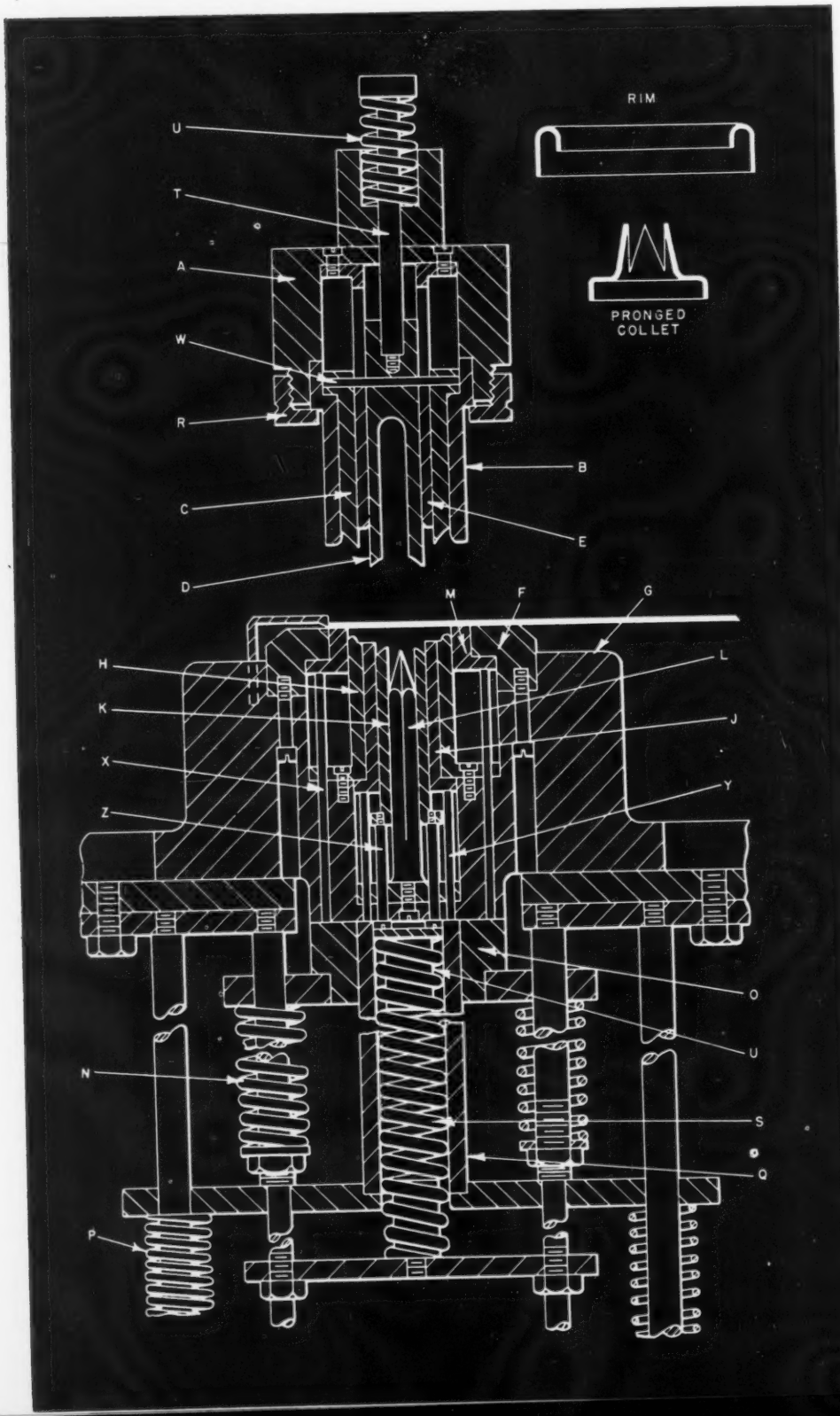
Fig. 1. (Above) Fixture for Milling Keyways in the Round Shanks of Drill-chuck Jaws B, as Shown at X. The Fixture Holds Twelve Jaws. Fig. 2. (Below) Fixture for Milling Flats on the Round Heads of Drill-chuck Jaws B. Ten Jaws are Milled Each Time the Fixture is Indexed

A slitting saw *E*, mounted on the arbor of a milling machine or a gear-cutting machine, enters the radial slots around the periphery of the fixture body to machine the keyways in the shanks of the jaws. The fixture is indexed by a dividing head. A hole is provided through the center of the body, so that the fixture can be mounted on an arbor. The form-turned jaw before and after the keyway milling operation is shown at *X*.

For milling the flats on the round head of the chuck jaws, the parts are held in the fixture shown in Fig. 2. Cast-iron body *A* is drilled and reamed to hold forty jaws *B*, ten on each of its four faces. Pins *C*, pressed into the fixture body, limit the depth to which the jaws enter the holes.

Since the flats on the heads of the jaws must be milled at 90 degrees to the keyways cut in the previous operation, modified socket-head cap-screws *D* are provided to locate the jaws axially in the fixture. The threaded ends of these screws are ground down to fit into the keyways, as shown.

Face milling cutters *E*, separated by spacing collars *F*, are mounted on the arbor of a milling machine or a gear-cutting machine. As in the previous operation, a dividing head is employed to index the fixture. A jaw is shown at *X* after flats have been milled on the head. Following this operation, a bevel is milled on the shank of the jaw, as shown at *Y*. A special pair of jaws was made to hold the part in a milling machine vise while milling the bevel.



Double Combination Die for Producing Two Different Parts

By BURNETT MENKIN
Los Angeles, Calif.

A rim shell is blanked and drawn and a pronged collet is simultaneously formed and pierced on the double combination die shown in Fig. 1. Cross-sectional views of these two parts are shown twice the actual size at the upper right of the illustration. Mounted on a press operating at 120 strokes per minute, the die will produce 57,600 rims and collets per eight-hour

Fig. 1. Double Combination Die in which the Rim Shown at the Upper Right is Blanked and Drawn while a Pronged Collet is Simultaneously Formed and Pierced

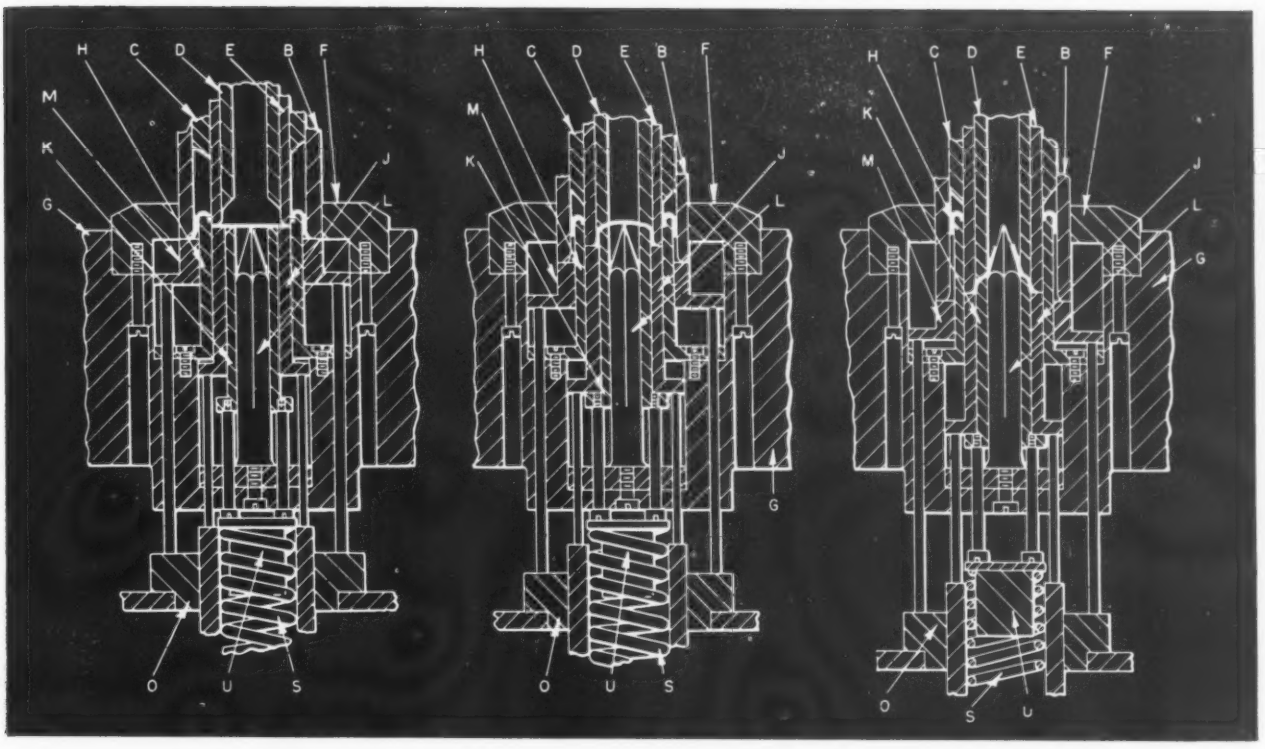


Fig. 2. Progressive Steps in Forming a Rim and Collet in One Operation. At the Left, the Rim has been Drawn over Tube H; at the Center, the Collet Blank has been Drawn into a Cup Shape; and at the Right, the Collet has been Pierced by Punch L to Form the Four Prongs

shift. A second power press and the time of another operator are therefore saved in the automatic production of these parts.

The lower end of punch-holder *A* is provided with a threaded cap *R* which retains the rim blanking and drawing punch *B*. Rim ejector sleeve *C* is joined to collet ejector sleeve *D* by a horizontal rod *W*, which can slide vertically in slots provided in collet blanking punch *E*. Knock-out rod *T*, which is screwed into ejector sleeve *D*, is normally held in its uppermost position by the action of spring *U*.

Rim blanking die *F* is stationary, being secured to die bed *G*, which is bolted to the bed of the press. Rim drawing tube *H* is also secured to the die bed, and is, therefore, stationary. Sleeve *J* holds the stock against punch *E* while the collet blank is being severed from the drawn rim, as shown at the left in Fig. 2. Sleeve *K* is employed to draw the collet blank, and spear-shaped punch *L* pierces the collet and forms the four prongs.

Buffer *O*, supported on springs *N*, is connected by pressure pins *X* to ring *M* and operates during the drawing of the rim shell. Buffer *Q*, mounted on springs *P*, is connected by pressure pins *Y* to sleeve *J* and operates during the drawing of the collet. Buffer *U*, supported on spring *S*, transmits pressure to sleeve *K* through screws *Z*. The heads of these screws simply rest on top of the buffer, to facilitate assembly and disassembly. Tension of the various buffer springs can be adjusted by means of the nuts shown.

In operation, punch *B* blanks the stock by penetrating the opening in die *F*. As the ram of the press descends pressure ring *M* is depressed, thus compressing springs *N* through buffer *O*. The blank then comes in contact with the top of rim drawing tube *H*. This forces the blank into the ring-shaped space between punches *B* and *E*, thus drawing the rim shell to the desired shape, as shown at the left in Fig. 2.

As the press ram continues to descend, the collet blank is sheared from the formed rim shell by the action of punch *E* and the inner cutting edge of tube *H*. The collet blank is drawn from between the lower face of punch *E* and the upper face of sleeve *J* as it is formed into a cup shape over sleeve *K* (see center view in Fig. 2). During this operation, sleeve *J* is forced downward, thus compressing springs *P* through buffer *Q* (Fig. 1).

When the flange at the lower end of sleeve *J* comes in contact with the collar at the bottom of sleeve *K*, both sleeves are lowered, thus compressing the heavier spring *S*. Collet ejector sleeve *D*, within blanking punch *E*, seats itself on top of the drawn collet cup, and forces it

down over spear-shaped punch *L*. Punch *L* pierces the top of the drawn cup and forms the four prongs on the collet, as shown in the view at the right in Fig. 2.

On the up stroke of the ram, sleeve *J*, through the action of springs *P*, lifts the completed collet from punch *L*. The collet is carried up within tubular punch *E* until it is ejected by sleeve *D*. Simultaneously, the completed rim shell is ejected from punch *B* by sleeve *C*. An air blast, controlled by the movement of the press ram, blows the completed parts from the die.

Marking Punches for Simplifying Lay-Outs

By ROBERT MAWSON, Providence, R. I.

With all the improvements that have been made in manufacturing methods, tools, equipment, and materials in order to reduce production costs, one operation performed in almost every machine shop seems to have never changed. That is the laying out of holes, where drill jigs are not used in the machining operation.

For example, to drill a hole in the hub of a gear, the general procedure is to chalk the surface of the hub where the hole is to be drilled, measure with a scale the correct distance from the face of the hub, scribe a line on the hub at that distance, and center-punch a mark to coincide with the scribed line. One shop recently made a tool that simplified this job. The tool, shown at the left in the accompanying illustration, is made from flat steel stock, 3/16 inch thick, with the distance *B* equal to the distance that the center of the hole has to be from the face of the work. A conical surface is ground at *C*, similar to a center-punch.

To use the tool, a workman simply places the flat surface *D* against the face of the work-piece and makes a blow with a hammer on the upper end of the tool. Center-punch *C* thus marks the position on the piece for drilling the hole. A number of these marking punches can be made to suit varying distances *B*.

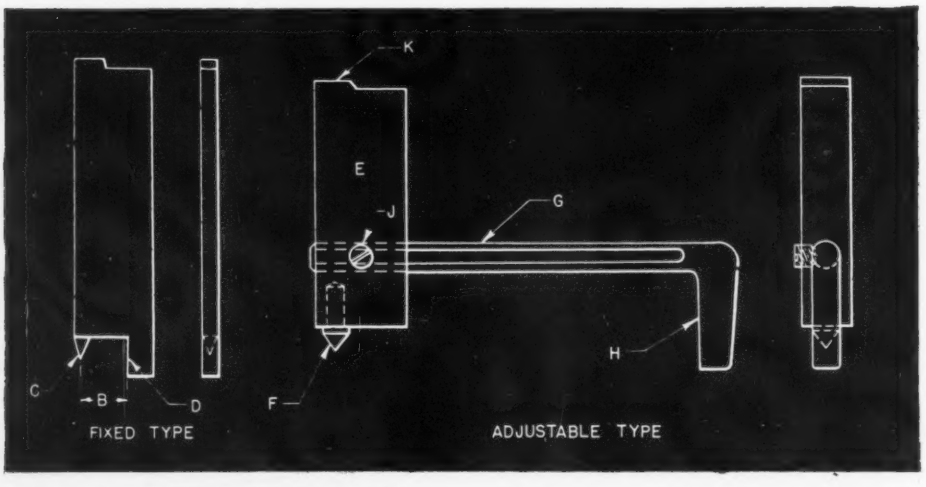
An adjustable type of marking punch that permits one tool to be used when dimension *B* varies is shown at the right. This tool is made with a machine-steel body *E*, in which is placed a center-punch member *F*. A hole is drilled and reamed in the body for the locating rod *G*, which is also made of machine steel. Graduations are scribed on the face of this rod to represent the distance between the center-punch member and face *H* of the rod.

To use the adjustable type marking punch, the operator simply loosens set-screw *J* and slides the rod until the scribed mark that corresponds with the desired distance from *F* to *H* coincides with the right-hand face of the tool jaw. After locking the rod in place by tightening the set-screw, face *H* is placed against the surface of the piece being laid out and a blow with a hammer at *K* will center-punch the piece in the correct position.

It is to be noted that the path of the blow of the hammer in both types of marking punches is directly in line with the center of the punch, which prevents tilting.

* * *

The expansion of the machine tool industry in the United States since the advent of the motor vehicle proves that the use of automatic machines manned by unskilled workers does not replace highly skilled craftsmen; it merely transfers them to another department of the economy, where the opportunities for the application of their skills have been enlarged by the increased use of precision machinery in mass production.



Fixed and Adjustable Types of Marking Punches that Simplify Location of Holes for Subsequent Drilling

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

Effective Use of Visual Aids in Selling

THE best "kit of sales tools" won't help the sales engineer unless correctly used. Sales tools are frequently mishandled, just as machine tools sometimes are in a production shop. In showing a prospective customer samples of work produced on the machine under consideration, proper presentation of the samples includes:

1. An effective introduction of the samples.
2. An adequate explanation of the reasons for their excellence.
3. Establishment in the purchaser's mind of a definite impression of the results that such excellence could mean in dollars to him.

Samples of Work Produced on Machine

Did you ever see a machine tool salesman, with samples loose in his hand, walk into a purchasing engineer's office? "Take a look at these," he may exclaim as he drops the samples on the desk. "That's what our No. 4 grinder will do." Such an introduction of the samples would be like bringing along a factory expert and failing to introduce him or establish his standing.

In contrast, consider the sales engineer who carries sample parts neatly wrapped. Before opening the package, he will set the stage by picturing, say, the No. 4 grinder he proposes to supply, and the relation of the sample parts to that machine.

Most likely, the prospect's interest will be aroused; he may even become anxious to see what the package contains.

With the prospect examining the samples (perhaps with a micrometer or magnifying glass that the sales engineer slips out of his pocket), the sales engineer can readily establish the "why" of the excellence of the work finish and explain how it results from the design, materials, and workmanship of the No. 4 grinder. The concluding sales arguments should deal with results—greater accuracy, more uniformity, etc.—all summed up in a saving in customer dollars.

Such a presentation is likely to be convincing, but before the sales engineer starts to relate sales arguments or drive toward a conclusion, he should carefully wrap up the samples. Thus he will avoid the distraction that may result from a continuing display. And before changing the subject or concluding the interview, he should ask who else in the prospect's organization might be interested in looking at the samples. Thus he may get a chance to repeat his sales demonstration to others.

Samples of Machine Parts

These same principles hold true in displaying small sample parts of the machine itself. The sales reason in displaying such parts is to illustrate the quality of the machine as a whole due to superior design and materials, closer limits of accuracy, and better finish. Here again, the sales engineer should establish the "why" of the quality and the results in terms of machine performance in the purchaser's plant.

Displaying Installed Equipment

Many sales engineers are alert to the value of taking prospects to see installed equipment in other plants. Besides carefully planning the procedure, it is important to shape and point the illustrative sales arguments. Your prospect may be wary on certain construction and operating features. Often those in charge of the operating equipment who are friendly to the sales engineer may be induced to stress success features aimed directly to meet the particular prospect's questions and doubts. This is simply the art of getting a satisfied customer to help you sell an individual prospect.

The principles applying to the presentation of work and machine samples also apply to everything else in the sales engineer's "kit of sales tools."

Technical literature, for instance. How often it is simply handed to the prospect without carefully explaining its make-up and contents. Take the time to show the prospect how the literature can be used.

Even the proposal for a machine should be "sold," not simply handed to the prospect. A brief review of the proposal, emphasizing its logical arrangement and completeness, will build up interest. Such a summary may also avoid further inquiry and subsequent correspondence.

No sales tool automatically sells itself. Each falls into human hands, including those of competitors. Each possesses a degree of potential drama. Each must be sold. Take a lesson from the book agent or from the competent Fuller Brush salesman.

Potter & Johnston Company Celebrates Fiftieth Anniversary

THE fiftieth anniversary of the Potter & Johnston Co., Pawtucket, R. I., was celebrated on December 28 with an open house for the employes and their families, which was attended by over 1200 persons. The concern was started in April, 1898, when James C. Potter and John Johnston hung up the first Potter & Johnston sign on the second floor of a building in Pawtucket. There was only 6000 square feet of floor space in these quarters, but within the year the working area was doubled.

Machine tools of three different types were the first products—a shaper, a manufacturing lathe, and an automatic chucking and turning machine, the latter being the ancestor of the automatics built today by the company. One hundred machines were shipped from the early plant in less than a year and a half. During its history, in addition to machine tools, the concern has built textile machinery, linotype machines, air-brake operating valves, lubricators for automotive upper cylinders, oil burners, automatic chokes for automotive engines, water filters, and other products. Prior to World War II, however, all facilities were devoted to producing automatic turret lathes.

Since March, 1948, the company has been a subsidiary of Pratt & Whitney Division Niles-Bement-Pond Co. It is interesting to note that one of the early partners, Mr. Johnston, left Pratt & Whitney in 1898 to participate in founding the Potter & Johnston Co.

Visitors to the Potter & Johnston plant during the celebration of the fiftieth anniversary of that company

Shop Equipment News

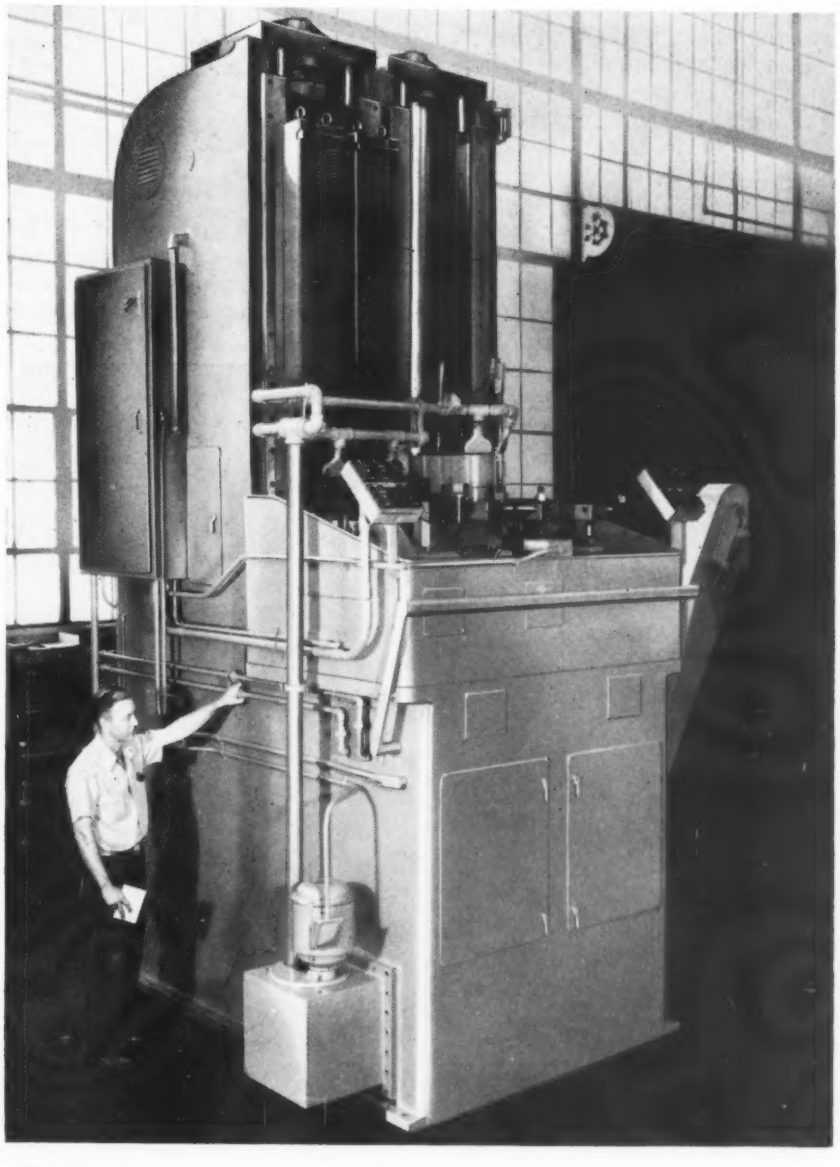
Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

American Duplex Surface Broaching Machine

The American Broach & Machine Co., Division of Sundstrand Machine Tool Co., Ann Arbor, Mich., has recently completed the manufacture of what is believed to be the largest duplex surface broaching machine ever built. This massive unit, equipped for broaching large Diesel-engine bearing supports, has a capacity of 40 tons, a 72-inch stroke, is over 15 feet in height, and weighs more than 34 tons.

An outstanding feature of this machine is the automatic cycle of the left-hand table and the right-hand broach arbor, both of which index six times during one complete broaching cycle. The left-hand station surface-broaches the step joint faces in six passes and the right-hand station rough-broaches the half-round surface in six passes.

The part broached weighs over 150 pounds. Approximately 1/2 inch of stock is removed in the broaching operation on about 110 square inches of surface area. A conveyor is provided to handle the excessive amount of chips accumulated in broaching such a large part. Production of this part has been increased twenty times over that obtained with the machining method previously employed. The broaching machine is equipped with interlocked electrical controls, and provides for continuous machine cycle operation during the six passes required to complete one part.....61



Huge duplex surface broaching machine built by the American Broach & Machine Co. for rough and surface broaching step joint faces of large Diesel-engine bearing supports

Metal-Working Lubricant

A sulphur chlorinated water-soluble, metal-working coolant and lubricant known as "Esscee Soluble No. 820" has been developed by Lubricants Incorporated, Fisher Bldg., Detroit 2, Mich. This lubricant can be used wherever a soluble oil is permissible in metal-working operations. It will not harm the skin of work-

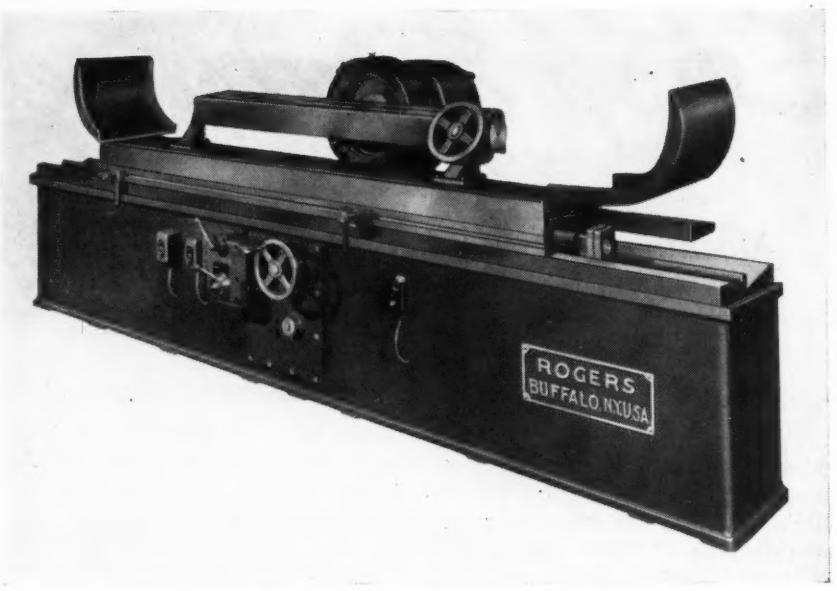
To obtain additional information on equipment described on this page, see lower part of page 230.

men, cause infection, become rancid, stain, or induce corrosion. This compound also has the advantage of remaining stable after long storage periods. It is suitable for machining all S A E steels, being particularly well adapted for threading, tapping, and broaching Monel metal, chromium, nickel, tungsten, and stainless steels. Also gives good results in drawing, piercing, and stamping ferrous metals. 62

Rogers Hydraulic Knife Grinder

A Type "NT" hydraulic knife grinder with a hydraulic drive which permits obtaining any desired table speed from 10 to 70 feet per minute by simple fingertip control has been brought out by Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y. This machine is adapted for grinding shear blades and paper, chipper, veneer, and other straight knives. The fine adjustment of grinding speed permits the operator to quickly select the speed that will give the best finish.

The machine has self-aligning 5-inch V-ways on the cabinet base. The rigid carriage absorbs the grinding pressure and permits heavy cuts and fast feeds with a minimum of vibration. An automatic motor-driven oiling system provides a constant, clean film of oil for the table and bed ways, which assures long machine life. The 16-inch segmental grinding wheel is operated by a 7 1/2- or 10-H.P. motor, as desired, and a separate 2-H.P. motor controls the hydraulic system. Seven sizes of this grinder are available, ranging from 38 to 134 inches. 63

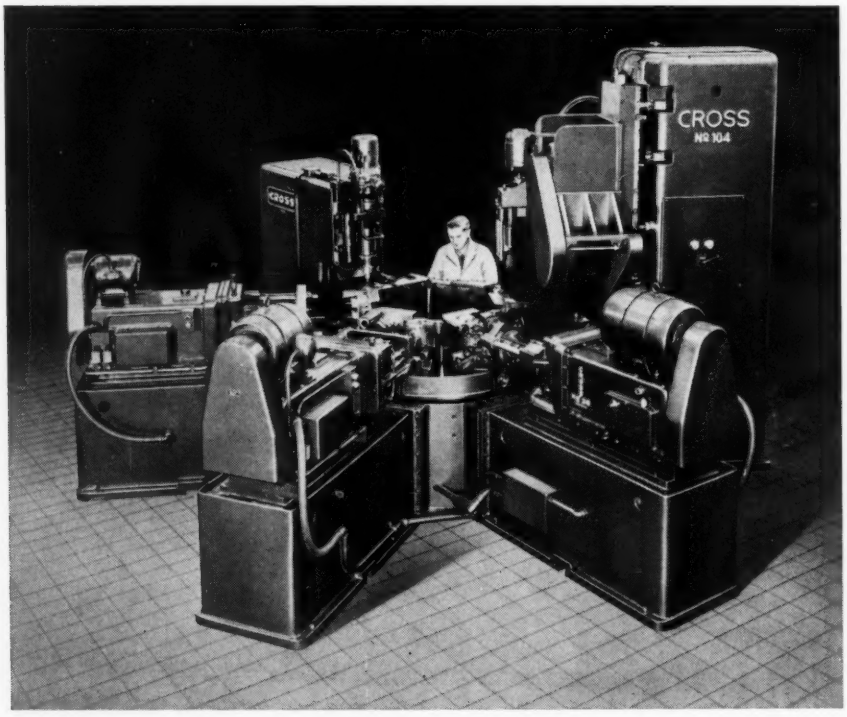


Hydraulic knife grinding machine brought out by Samuel C. Rogers & Co.

Cross Machine with Double Loading Feature

The Cross Company, Detroit 7, Mich., has built a special machine for a large automobile manufacturer, which is designed to increase the output of water-pump bodies. Parts are milled, drilled, bored, reamed, and tapped on the new machine at the rate of 90 pieces per hour by a single unskilled operator. With each cycle of the machine, the operator loads a new water-pump body at the first work position and transfers the semi-finished part from the first to the second position. Second-operation work is thus completed simultaneously with the first chucking. The exceptionally high production obtained is made possible by double loading of the parts while the machine is cutting and by the fact that ten parts are machined simultaneously and progressively.

The machine has a six-station, power-operated index-table. Although specially designed for machining water-pump bodies, the standard Cross sub-assemblies incorporated in this machine can be regrouped into various combinations for producing many different parts. This feature also provides for part design changes and lower maintenance costs. Other outstanding advantages include hydraulic feeds for milling, drilling, boring, and reaming. 64

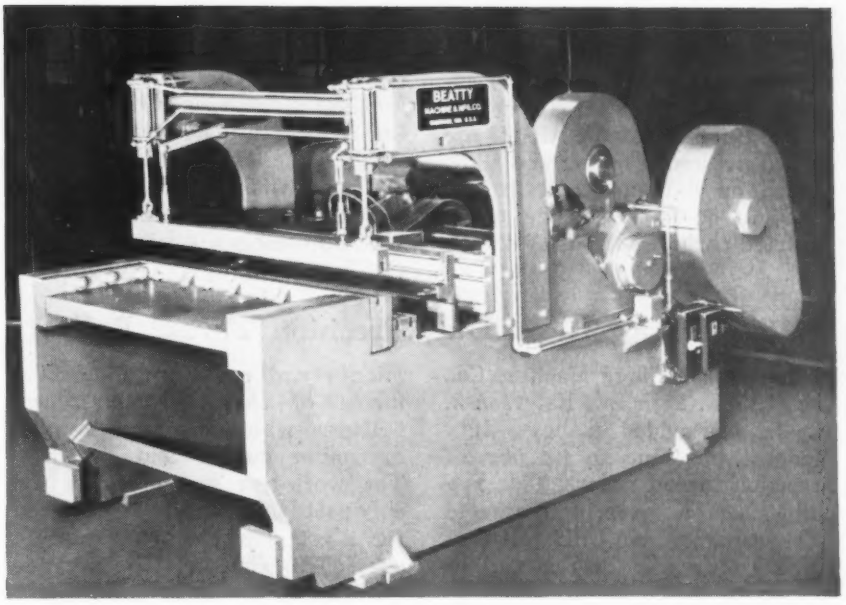


Special machine for processing water-pump bodies built by The Cross Company

To obtain additional information on equipment described on this page, see lower part of page 230.

Beatty Horizontal Multiple Punch

A horizontal multiple punch believed to be one of the first of its type is announced by the Beatty Machine & Mfg. Co., Hammond, Ind. This machine is designed for the multiple punching of flanges on long wide sheets, and has provision for mounting the tools at varying center-to-center distances across the ram face. An air-clamp device holds the material down during the operation. Stripping is accomplished by air cylinders, which travel with the ram. The frames are of welded steel plate, and the clutches are of the jaw type, with motor drive through a V-belt to the flywheel.



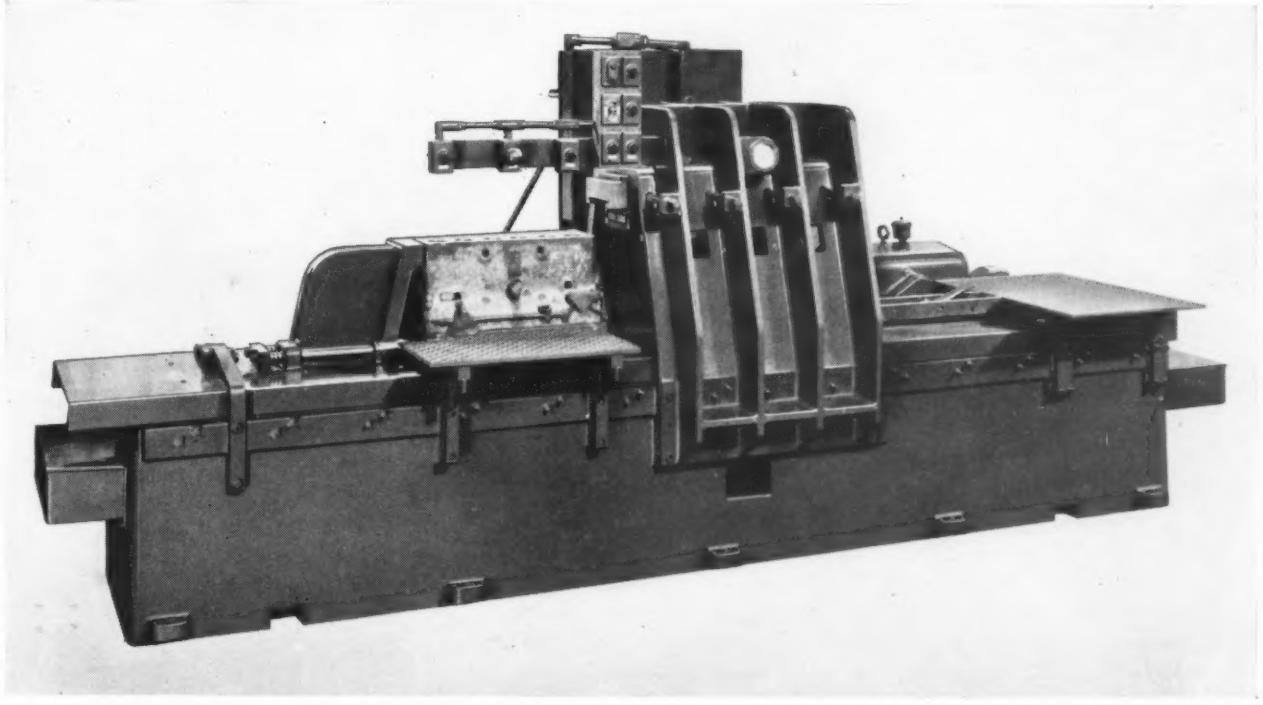
Horizontal multiple punch built by the Beatty Machine & Mfg. Co.

The machine is available in capacities of 50 to 300 tons. Specifications on the 200-ton machine illustrated are as follows: Distance between housings, 63 inches; stroke, 6 inches; number of strokes per minute, 28; die space, with the ram in the rear position, 18 1/4 inches; ram width, measured vertically, 10 3/4 inches; ram length, right to left, 72 inches; table width measured vertically, 9 inches; table length, right to left, 72 inches; and depth of throat, 5 inches.....65

Oilgear Tunnel Type Horizontal Broaching Machine

The Oilgear Co., 1340 W. Bruce St., Milwaukee 4, Wis., has brought out a 15-ton tunnel type horizontal broaching machine for finishing the gasket face of automobile cylinder blocks in one pass of the cutter. About 0.015 inch of stock is removed from the 7 3/4- by 26 1/4-inch surface at a production rate of three blocks per minute.

The slide stroke of this machine is adjustable up to 72 inches. The broaching speed is variable up to 60 feet per minute and the return speed up to 80 feet per minute. Actual peak capacity is 22 1/2 tons. The two-way variable-delivery pump is directly connected to a 40-H.P. electric motor. The weight of the machine is about 24,000 pounds.



Tunnel type cylinder-block horizontal broaching machine made by the Oilgear Co.

To obtain additional information on equipment described on this page, see lower part of page 230.

When the machine is in operation, the rough-finished block is moved from the conveyor to loading position in the angle type fixture. Dual safety buttons are then depressed, causing the slide, guided on hardened and ground ways, to be pulled to the right. Inverted carbide tipped tools fastened to the under side of the bridge serve to finish-broach the top of the cylinder block. The finished block then moves on to the unloading platform and conveyor line. The machine is equipped with a selector switch for either manual push-button or semi-automatic operation. 66

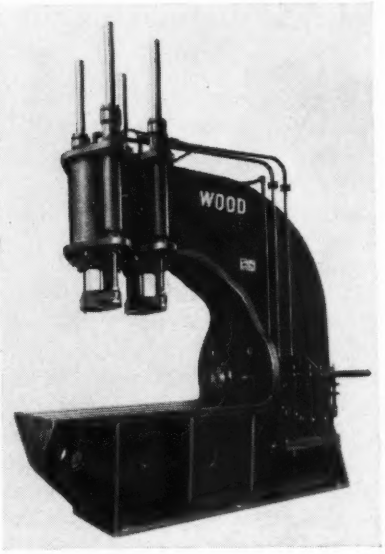
Watson-Flagg Heavy-Duty Precision Thread Roller

The Watson-Flagg Machine Co., Inc., 845 E. 25th St., Paterson 3, N. J., has added a heavy-duty Model C machine to its line of precision thread rollers. This machine has a greatly increased work capacity and will roll continuous threads, serrations, or knurls. It will roll threads from 0.138 inch up to 4 inches in diameter, with a maximum of 8 pitch. The regular thread length capacity, when not "through-rolling," is 2 1/4 inches and the maximum capacity 3 1/4 inches. Threads can be rolled on any material that has an appreciable percentage of elongation.

Threads, knurls, or serrations are formed as the blank is rotated between two cylindrical dies having an average diameter of 6 1/2 inches. These large dies provide high surface rolling speeds of 200 to 540 feet per minute and an average of 20.4 inches of useful circumference, features which combine to give maximum output and die life. The work-rest and dies are the only parts that need to be replaced for a complete change-over from one job to another. The average change-over requires from thirty to forty-five minutes. Cycle control, positive stop, and micrometer size control can be quickly and easily adjusted. 67

Wood Sectional Flanging Press

A hydraulic press for use in sectional flanging operations, and which can also be used for joggling and upsetting work, has been brought out by the R. D. Wood Co., Public Ledger Building, Philadelphia 5, Pa. This press has a capacity of 200 tons with



Sectional flanging press brought out by the R. D. Wood Co.

the two vertical main rams operating in unison. The capacity with a single vertical ram in operation is 100 tons. The horizontal ram, with a capacity of 72 tons, has a double detachable cross-head of cast steel with a bored and tapered keyslot for adjustment of the tooling.

The press is arranged for accumulator operation and is equipped for connection to the accumulator pipe line. It can also be furnished in a self-contained

Heavy-duty continuous precision thread-rolling machine brought out by the Watson-Flagg Machine Co., Inc.

To obtain additional information on equipment described on this page, see lower part of page 230.

model with pumping units and control equipment. These presses are built in capacities ranging from 150 to 300 tons. Larger sizes are available for special requirements.....68

Grob Vertical Cut-Off Machine

Grob Brothers, Grafton, Wis., has developed a vertical type cut-off machine with a capacity for bars or work 18 by 18 inches in size. This machine makes it possible to cut out sections from plates, permits adjusting saw guides closer to work, and facilitates placing the work in the machine. The frame on which the two 18-inch saw-blade wheels are mounted travels on rollers, which assures accurate, straight feeding of the frame and saw.

The cutting cycle of the machine is completely automatic. Two graduated scales, one on the side of the vise and the other at the saw frame where the feed-stop is located, show at a glance just how many inches of cutting are required, so that the indicator on the feed-stop can be adjusted for the correct length. The saw can also be operated manually.

The electrically controlled work feed pressure can be adjusted from 0 to 100 pounds. A hydraulic check control for the work feed facilitates cutting sheet metal and thin tubing, as well as cutting through openings in heavy work. The saw blade is 3/4 inch wide by 162 inches long. Special guides, a combination of rollers, and hard aluminum bronze pieces provide extremely accurate means for guiding the saw blade. The upper guide is adjustable to a height of 18 inches, and the quick-acting vise opens to a maximum distance between jaws of 22 inches. A 1-H.P. motor is used for the five-speed saw-blade drive, and a 1/3-H.P. motor is employed for the automatic work feed. The machine requires a floor space of 31 by 58 inches, has a height of 78 inches, and weighs 1320 pounds. 69

Sundstrand Contour Milling Machine

A cam-controlled contour milling machine, combining in one unit, a vertical spindle milling head, a cam follower, a cam-carrying table, and a rotary work-table, has been built by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill. The new machine provides a wide selection of automatic cycles for both internal and external milling of practically any contour on work parts up to 5 inches in diameter. The compact design permits a group of machines to be installed in line for operation by one man, who need only unload, reload, and start the automatic cycle of each machine. Another feature of the machine is its ability to cut master cams from sample parts, thus eliminating the necessity for developing intricate cam profiles.

The milling head and cam follower spindle are mounted together on a swinging arm. Since the ratio between the movement of the cam roller arm and the cutter arm is 2 to 1, any error in the cam is reduced by one-half on the finished part. In most cases, the master cam can be made considerably larger than the work to eliminate excessively steep cam rises.

The cutter-spindle is driven by a V-belt from a 3/4-H.P. variable-speed unit, which provides stepless adjustment of the spindle speed within the range of 425 to

Vertical type cut-off machine brought out by Grob Brothers

Contour milling machine for small parts, built by Sundstrand Machine Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 230.

4150 R.P.M. The cutter-spindle is mounted in a head having a vertical adjustment of 3 1/4 to 8 inches. The spindle quill is provided with hydraulic vertical feed, and has a movement of 1 1/4 inches, controlled by dogs for rapid advance, feed, and rapid return. Settings for various diameters of work, cutter wear, and depth of cut are obtained through a micrometer adjustment of the arm.

The 6-inch diameter rotary table and the cam-carrying spindle are worm-driven by the same motor at a 1 to 1 ratio. Table feeds of 0.2 to 5 R.P.M. are available, and the rapid traverse rate is 40 R.P.M. Dogs on a cycle disk control the degree of table rotation for rapid approach, feed and return movements in either direction up to 1 1/3 revolutions. The machine has over twenty-four possible cycle combinations which can be quickly set up for handling different kinds of work. 70

Gisholt Cylindrical "Superfinisher" for Small Parts

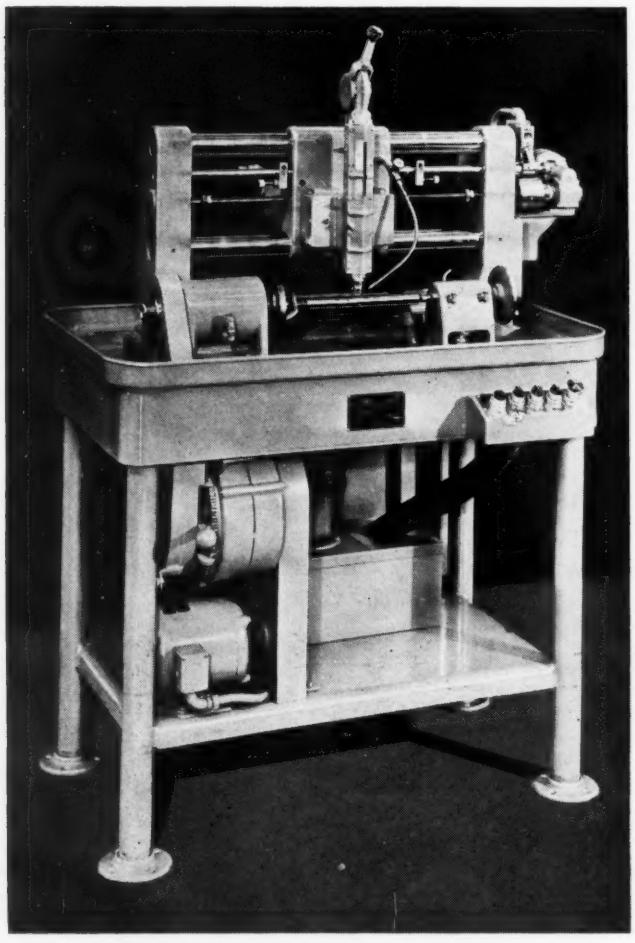
A general-purpose cylindrical "Superfinisher," suitable for finishing small parts, such as plug gages, hydraulic cylinders, pistons, and shafts of various kinds, has been added to the line of the Gisholt Machine Co., Madison 10, Wis. This Model 50 machine has a capacity of 12 inches between centers, a maximum working diameter of 3 inches, and an 8 1/2-inch swing. It will handle work weighing up to 100 pounds. A spindle speed range of 40 to 1000 R.P.M. is available, which permits selecting the correct speed for any finish desired.

The quill is spring-loaded, and has means for adjusting the pressure from 0 to 45 pounds. Equipment includes an adjustable tailstock and a complete lubricating system. The motor-driven traverse shown installed on the right-hand column of the machine and a centerless roll drive for parts having no centers are standard attachments available for the new machine. 71

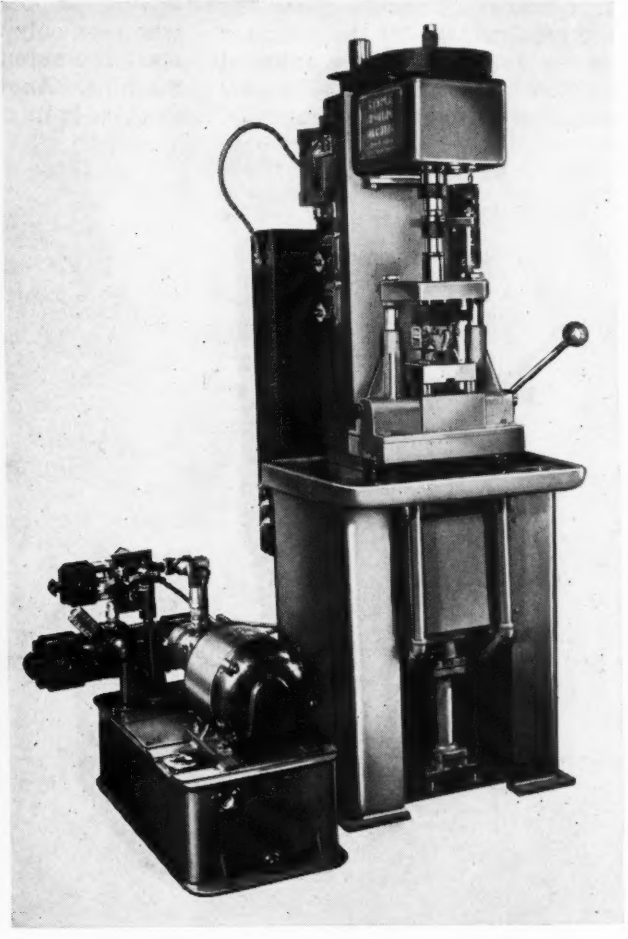
Staple Vertical Honing Machine

A Model B7 vertical honing machine has recently been added to the line of equipment manufactured by the Staple Engineering Co., 1315 S. Woodward Ave., Birmingham, Mich. This machine is hydraulically operated and electrically controlled. It is adapted for work up to 6 inches long, having inside diameters ranging from 1/2 inch to 4 inches, inclusive. The timing cycle is adjustable from 3 to 180 seconds with standard equipment. Sizing is manually controlled through a graduated dial. The reciprocating work-table is 6 inches wide by 18 inches long, and has a travel of 8 inches.

A variable-speed drive is pro-



Gisholt general-purpose "Superfinisher" for small cylindrical parts



Vertical honing machine added to the line of the Staple Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 230.

vided for the honing spindle. The honing stones are fed outward and contracted automatically, and the pressure and rate of feed are adjustable, so that the best operating conditions can be maintained throughout the honing cycle. The machine is supplied with all the necessary electrical controls, a self-contained hydraulic unit, and a coolant pump and tank. 72

Warco Press Designed for High-Speed Operation

The Warco Press Division of the Federal Machine & Welder Co., Warren, Ohio, has recently designed a 75-ton press for producing a large variety of stampings accurately and continuously at high speed. This press is of welded and stress-relieved steel construction, with hand-fitted square gibbing that assures accurate alignment. It has a full eccentric shaft mounted in extra long bearings and a short rugged one-piece barrel type pitman adjusting screw.

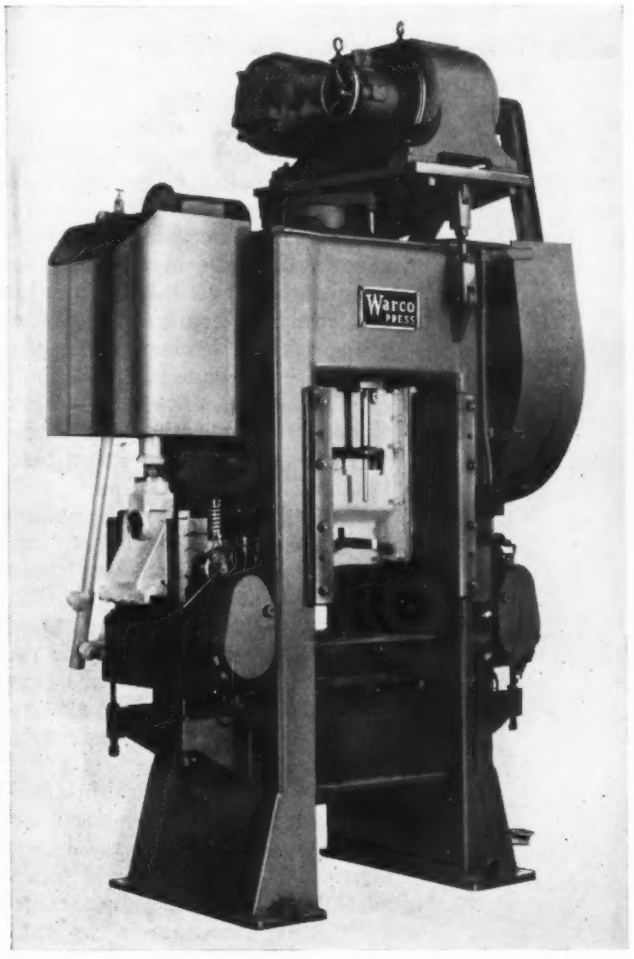
Air counterbalancing equipment is employed to reduce the shock of "break through." All wearing surfaces are lubricated by an automatic system. Other features include variable-speed drive; easily accessible location of all adjusting members; and provision for the installation of die cushions when required.

A Warco precision double roll feed designed for high-speed operation is furnished as auxiliary equipment. All moving parts of the roll feed are designed to keep weight to a minimum, consistent with strength and rigidity requirements, which results in greater feeding accuracy. Infinite variation is possible in feed lengths from zero to maximum. A synchronized scrap shear is provided if required. Other features are easily adjusted feed-line height and built-in stock oiler...73

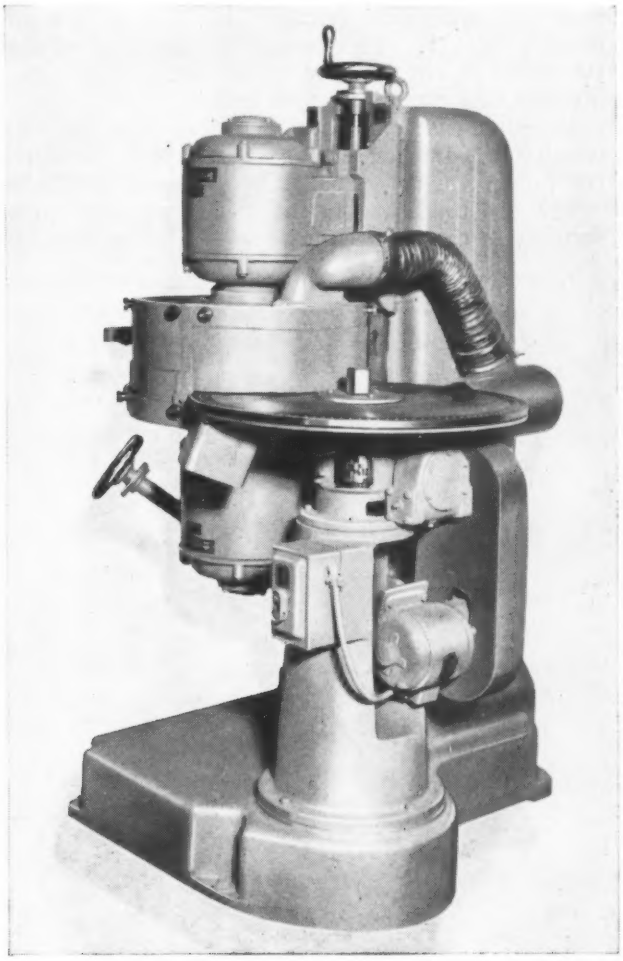
Besly Double Vertical-Spindle Machine Developed for Rapid Precision Grinding

Charles H. Besly & Co., 118-124 N. Clinton St., Chicago 6, Ill., have recently brought out a double vertical-spindle grinder designed for faster precision grinding of small parts. This machine is built to perform wet or dry grinding operations as fast as it can be loaded with work. When manually loaded by a skilled operator, an output of 2400 pieces per hour can be obtained, and with a hopper-feed attachment, 5000 or more pieces can be finished per hour, depending upon the design of the piece or the area ground.

Features of the new No. 905



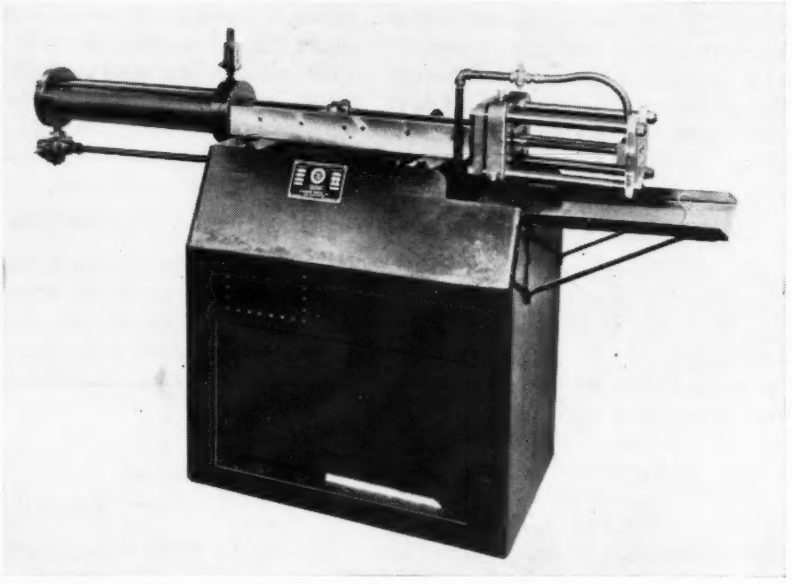
Warco press brought out by the Federal Machine & Welder Co.



Double-spindle vertical grinder built by Charles H. Besly & Co.

To obtain additional information on equipment described on this page, see lower part of page 230.

grinder include quick convertibility from one job to another by easy replacement of the feed-wheel; fast gravity loading and unloading obtained by the horizontal position of the feed-wheel; adaptability for handling such varied types of production grinding as coil-spring ends, carbon brushes, ceramics, plastics, and a wide variety of small steel, aluminum, copper, brass, and gray iron parts. Two 3-H.P., 1750-R.P.M. motors are used for the grinding heads. The machine has an over-all length and width of 41 7/8 inches and a height of 66 inches. Either 15-, 16-, or 18-inch diameter abrasive disks can be supplied. 74



Zagar broaching machine equipped with special attachment

Zagar Broaching Machine Attachment

Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 23, Ohio, has brought out an unusual broaching attachment devised for application to its standard 20-inch pull-broaching machine to convert it for push-broaching two holes at one time, maintaining accurate center-to-center hole spacing and exact positioning with relation to finished surfaces on the work.

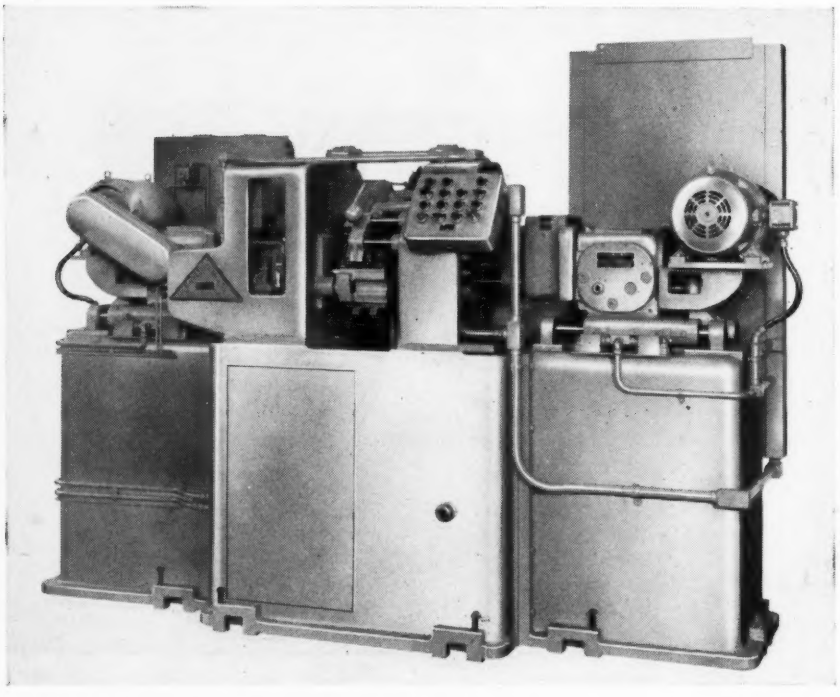
The two broaches are fastened securely in the ram of the attachment, which, in turn, is pushed by the ram of the broaching machine. The part is located on the head end of the broaching fixture, and the operation consists of pushing the broaches through the work and pulling them back. The return stroke serves to release the part, which drops down into the work tray. 75

Le Maire Two-Way Multiple-Spindle Tapping Machine

The Le Maire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich., has recently built a two-way, eight-spindle, horizontal lead-screw tapping machine designed for tapping four split sleeves at each cycle, with automatic unloading of the machined parts.

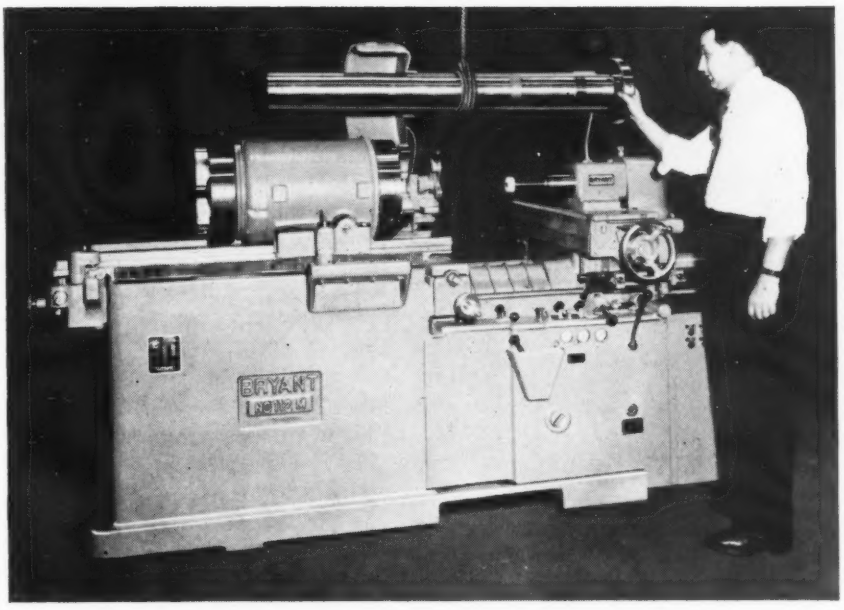
The machine consists essentially of a fabricated center base, which supports a three-station trunnion, and two cast-iron end bases, each supporting a lead-screw tapping unit which carries a four-spindle tapping head. At each of the three trunnion stations is mounted a double holding fixture that holds two split sleeves. The parts to be tapped are placed in position, and a sliding guide is moved into place to hold them until they reach the second station, where they are hydraulically clamped, then tapped, and unclamped. At the third station, the tapped parts drop into a chute. Four parts are tapped at each end in each operating cycle.

Operation of the machine cycle is automatic after the parts are loaded and the cycle button pressed. Coolant is provided for all taps. The production obtained with this machine is approximately 480 pieces per hour, allowing twenty-eight seconds for loading the work. 76



Le Maire two-way multiple-spindle machine for tapping automotive parts

To obtain additional information on equipment described on this page, see lower part of page 230.



Bryant internal grinder equipped for handling large precision work

Bryant Internal Grinder Equipped for Handling Large Work

The Bryant Chucking Grinder Co., Springfield, Vt., has brought out a No. 112-M internal grinder equipped with a double-chuck work-head for precision grinding large work, such as that shown suspended above the machine in the illustration. The machine is designed to grind special internal tapers on parts such as machine tool spindles and axles. The work-head can be moved longitudinally to properly position the work for grinding. A sine bar attachment provides means for accurately controlling the taper.

Both inside and outside surfaces and the face of the work can be ground at one chucking on this machine. An attachment allows the work-piece to be indexed 180 degrees so that concentricity can be assured when both ends of the piece are to be finished. When performing large external grinding operations, the work-head is moved to the left-hand end of the machine and a steadyrest is used to support the end to be ground.

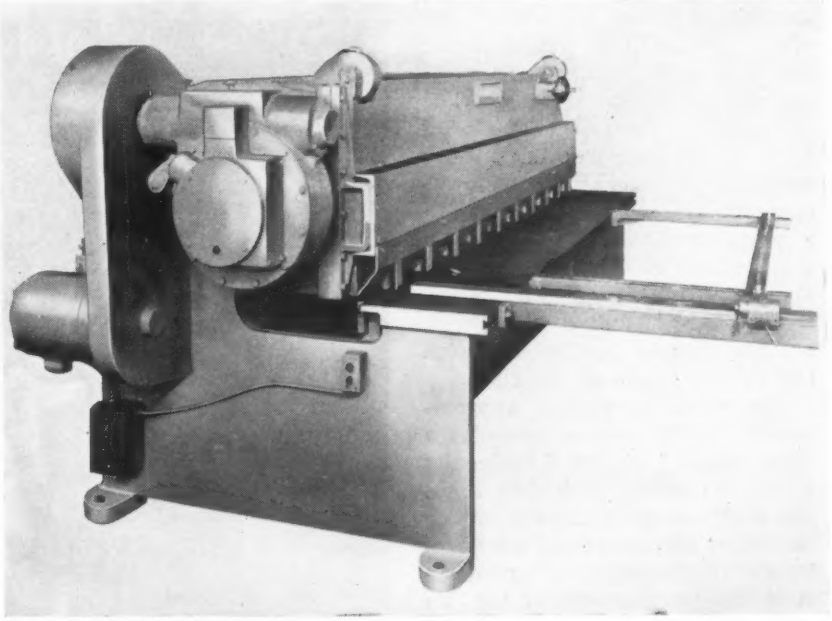
The work-head of the grinder can be removed and replaced by a fixture so that spindles can be ground while rotating on their own bearings. The work-head base is of the swiveling type and provides for grinding a maximum included angle of 30 degrees. To facilitate loading long pieces, the wheel-head assembly is moved hydraulically to the rear of the machine. Multiple-position stops can be provided for grinding stepped bores. 77

Columbia Steel Squaring Shears

Speed and accuracy of gage settings, as well as of shearing operations, have been developed to a high degree in the new series of steel squaring shears brought out by the Columbia Machinery & Engineering Corporation, Hamilton, Ohio. These advantages, as well as ease of operation, have been obtained by a motor-operated precision back-gage, a solenoid-operated clutch controlled by a foot-switch, and low over-all height. Rigid welded rolled-steel construction is employed to obtain greater strength, with reduced weight, and to permit the use of lighter foundations.

A feature of all the squaring shears in this line is a new worm-gear drive that is said to be exceptionally quiet and free from vibration. The high-carbon alloy steel clutch, with six jaws, is bolted to the web of the worm-gear, and is actuated by an electric solenoid through a portable foot-switch. The drive and clutch operate in an oil-tight dust-proof housing. Automatic hydraulic hold-downs, controlled by a cam, grip the work firmly before the cutting action begins. Blades of special analysis steel, which are said to give as much as four times the service life of ordinary blades, are standard equipment.

These squaring shears are available in seven sizes for shearing 3/8 inch to 1 1/4 inches mild steel in 6- and 10-foot lengths. All models can be had with special shear motor and V-belt drive...78



Steel squaring shears brought out by the Columbia Machinery & Engineering Corporation

To obtain additional information on equipment described on this page, see lower part of page 230.

Huge single-shot injection molding machine built by Watson-Stillman Co.

Watson-Stillman Single-Shot Injection Molding Machine

The Watson-Stillman Co., Roselle, N. J., has recently introduced a huge 48-ounce automatic single-shot injection molding machine. The new machine materially increases the size range of products which can be injection molded in one piece from thermal plastics An automatic stuffing arrangement is provided on the machine, which is said to increase its rated capacity from 40 to 50 per cent.

The machine is arranged for individual motor drive, and has radial piston type oil pumping equipment. It also has a new heating cylinder especially designed to deliver near-capacity shots of such materials as polystyrene without stuffing. The electrically controlled material feed is self-compensating. Both manual and automatic single-cycle controls are available through a selector switch. The injection plunger and clamp ram have feed and pressure adjustments. Automatic slow-down and slow-break are provided for the fast approach and return travel of the clamp.

The machine weighs approximately 85,000 pounds, occupies a floor space of 24 feet 6 inches by 4 feet 6 inches, is 9 feet high, and requires 300 gallons of oil for operation of its hydraulic system by a 60-H.P. motor. A stainless-steel hopper accommodates an entire barrel of plastic, which is processed at the rate of 200 pounds an hour.

The injection pressure is 21,000 pounds per square inch, and the clamping capacity 1000 tons. The daylight opening is 54 inches; minimum die thickness, 12 inches; and maximum die size, 30 by 50 inches. 79

Whiting Full-Vision Crane Cab

The Whiting Corporation, Harvey, Ill., has brought out a full-vision crane cab which permits the operator to see objects almost directly beneath the cab while seated in a comfortable position. The operator also has a lateral view throughout an area equivalent to two-thirds of a circle. This new style cab uses magnetic switching controls that permit all crane movements to be governed by a slight pull or push on short ball-tipped levers connected to low-voltage multi-point time-delay speed controls. The cab is weatherproofed and can be provided with air-conditioning, telephone communication, and fluorescent lighting. 80

Wysong & Miles Power Squaring Shear

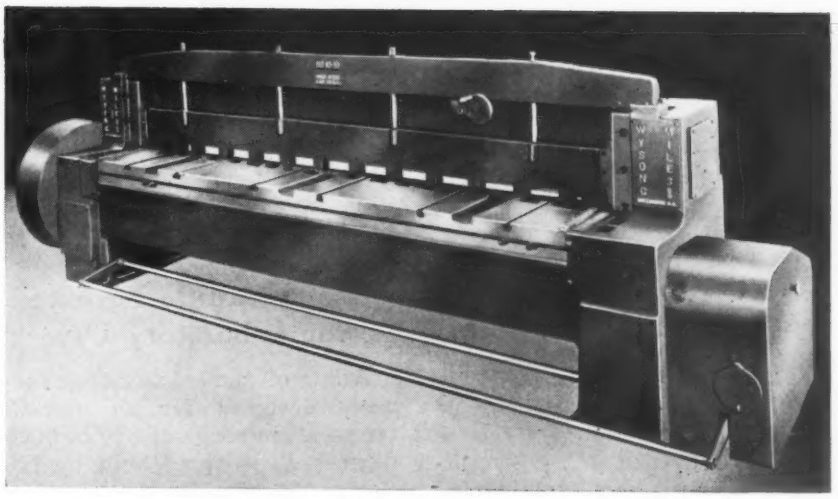
The Wysong & Miles Co., P.O. Box 2068, Greensboro, N. C., has introduced a new No. 10–10 power squaring shear having a capacity for cutting 10-foot, 10-gage mild steel. This machine is of semi-steel construction, the bed, end frames, knife-bar, hold-down, and top girder all being one-piece castings. The shear has underdrive, and the weight has been carefully distributed to obtain rigidity and stability. To insure accurate cutting, the bed is squared with the end frames in all three directions. Ways for hold-down and knife-bar travel are accurately machined from steel and hand scraped to insure true travel without deflection.

Full-vision crane cab brought out by the Whiting Corporation

To obtain additional information on equipment described on this page, see lower part of page 230.

Eccentrics for moving the knife-bar through the stroke cycle are housed between two bearings within each end frame. The eccentrics dip into a bath of oil, which insures constant, thorough lubrication and cool operation. When the foot-treadle is depressed, the clutch engages instantly, distributing the load equally over all nine jaws. The non-repeat unit is built into the clutch and can be set for single-stroke shearing.

The knife-bar brake is cam operated and engages only when the knife-bar is at the top of the cycle. An individual spring-actuated plunger is provided for each hold-down foot to compensate for clamping sheets of varying thicknesses and small strips. The front-operated, ball-bearing parallel back gage is adjustable to 0.0078 inch by means of a handwheel. Other standard equipment includes alloy blades with four cutting edges, three front-gage brackets, steel front gage, 7 1/2-H.P. motor, and all electrical equipment. 81



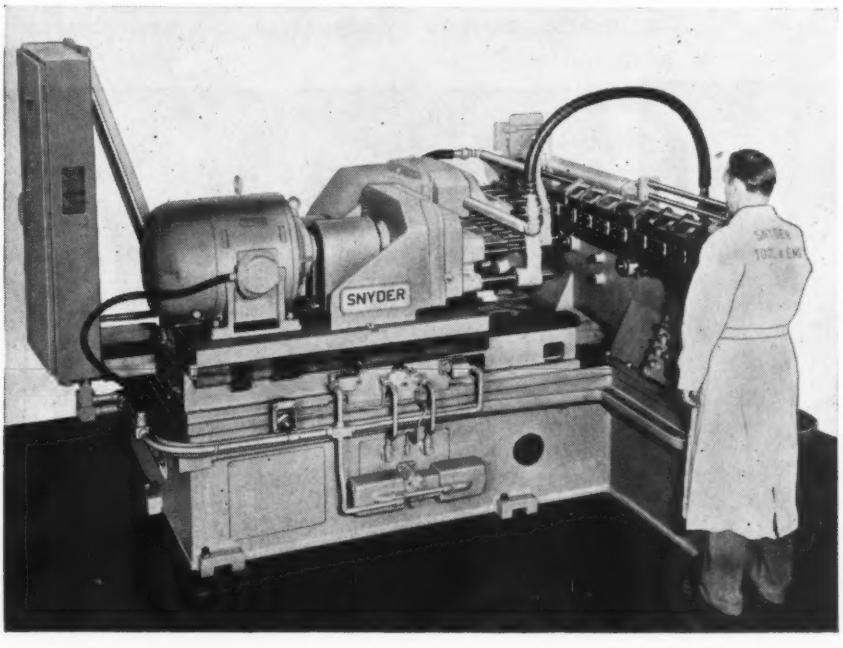
Power squaring shear introduced by the Wysong & Miles Co.

Snyder Automatic Drilling, Countersinking, and Tapping Machine for Automotive Part

A drilling, countersinking, and tapping machine which reduces the work cycle for processing automotive upper control arm assemblies to sixteen seconds and requires only 25 per cent of the former floor space has been built recently by the Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich. The machine has one loading and two work stations. Four parts are loaded into the guide rails against the rest plate, and the automatic work cycle is started. The parts are then automatically shuttled into the drilling station, where a bushing plate equipped with locating pins and spring-loaded buttons advances, locates, and clamps the parts as the machining cycle starts. High-speed steel drills are used in the 16-spindle drill head for this operation, with a stroke of 10 inches, feed of 0.009 inch, and speed of 60 surface feet per minute.

When the drilling and countersinking cycle is completed, the parts are automatically shuttled to the tapping station, where they are again located and clamped in position by a hydraulic pressure plate equipped with locating pins and spring-loaded buttons. A 16-spindle, individual lead-screw type tapping head with Snyder safety tap drivers performs the tapping operation at a speed of 40 surface feet per minute. Thus sixteen 7/16–20 holes are completed during each work cycle.

The drilling head is driven by a 20-H.P. motor, and the tapping head by a 10-H.P. motor. A work cycle of sixteen seconds produces 788 pieces per hour at an operating efficiency of about 87 per cent. An electrical interlock safety system is employed to synchronize the work cycle. The machine base is of welded steel construction, with chip and coolant pan, ribbed and normalized for rigidity. The floor space required is 88 by 107 inches. 82



Special automatic machine developed by Snyder Tool & Engineering Co. for drilling, countersinking, and tapping automotive parts

Gear Lapping Compound

An abrasive compound with an oily-paste base has been developed by the United States Products Co., 518 Melwood St., Pittsburgh 13, Pa., for the fine finishing of all types of gears. It can be applied with a brush or paddle, and

To obtain additional information on equipment described on this page, see lower part of page 230.

will adhere to the gear teeth while the gears are in operation or being lapped. This compound is applicable not only in new production finishing, but also for eliminating vibration from existing installations, thus resulting in quiet running conditions.....83

Pratt & Whitney Multiple-Station Piston Gage

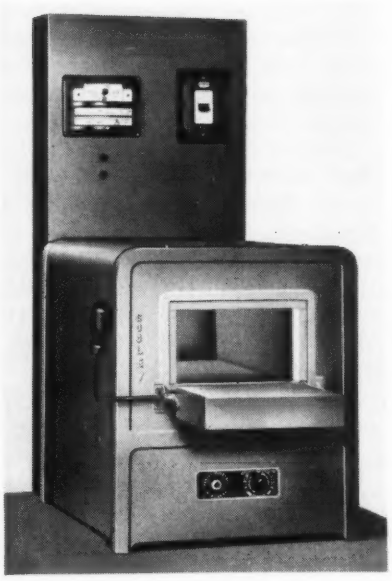
To facilitate the assembly of automotive pistons, the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn., has developed a specially designed multiple-station gage which checks six dimensions simultaneously, stamps two grade classifications, and automatically shows the number of pistons of each grade inspected. Pratt & Whitney "Electrolimit" and multiple electric-contact gaging units are incorporated in this gage. Simply pushing the piston into the gaging position and looking at the instrument panel gives the inspector complete information on each piston.

The piston is automatically marked on the top end with grades corresponding to the skirt diameter and the pin-hole diameter. The meter at the left indicates the grade of pin-hole diameter, and operates the second row of checking or indicating lights at the top of the gage. The meter at the right indicates the grade of skirt diameter and operates the top row of lights. The width of the ring grooves is checked by observing the red and green lights in the center. A green light indicates an under-size part, and a red light an over-size part. When neither light is on, the ring groove width is within the specified size limits. 84

Cooley Muffle Furnace for Laboratory Use

A line of muffle laboratory furnaces designed for an over-all temperature range of 300 to 2000 degrees F. is being built by the Cooley Electric Mfg. Corporation, 38 S. Shelby St., Indianapolis 7, Ind. These new furnaces, with integral selective power modifier, are designed for experimental testing, enameling, fusing, igniting, precipitate drying, etc. They are made in five models, which operate at maximum temperatures of 1750 and 2000 degrees F. This line of furnaces is further augmented by the Cooley Models ACL and ACH recirculating air draw furnaces, with built-in selective power modifier, for temperatures up to 900 and 1200 degrees F., respectively.

In these furnaces, a temperature uniformity of $+5 -0$ degrees F. is maintained by means of the built-in selective power modifier, used in conjunction with an indicating-controlling type pyrometer. This accuracy is held at temperatures as low as 300 degrees F. The modifier corrects power input to prevent the temperature from rising beyond the set point.

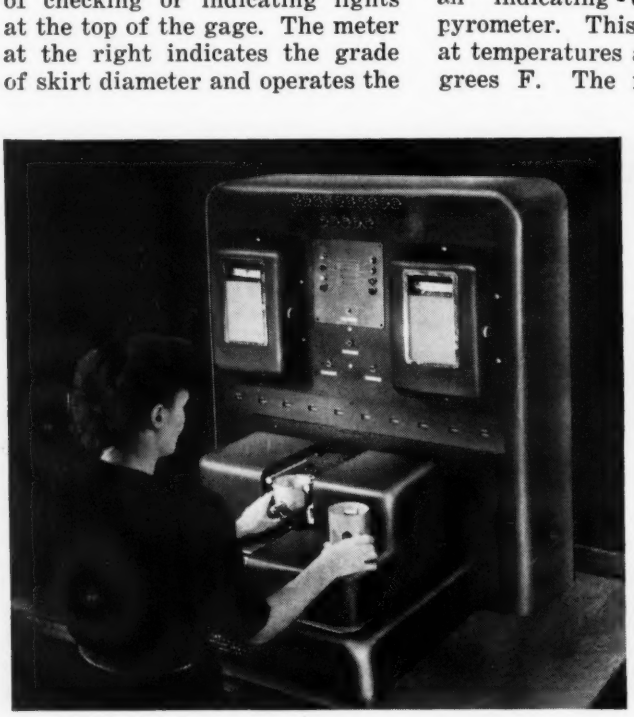


Cooley laboratory muffle type furnace with integral selective power modifier

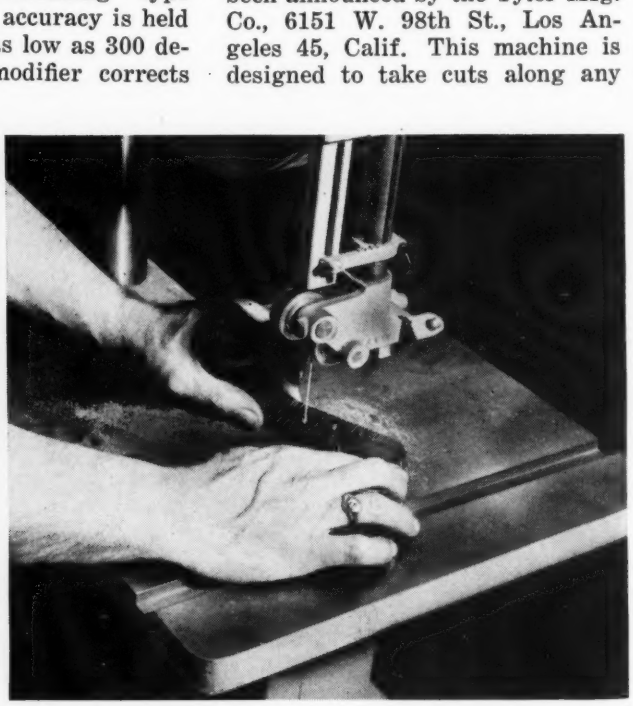
The furnaces are also adapted for tool and die tempering, being especially useful in tempering high-speed steel tools. 85

Tyler Band Saw with Spiral Blade

A power band saw with a new type of spiral blade and a unique planetary transmission drive has been announced by the Tyler Mfg. Co., 6151 W. 98th St., Los Angeles 45, Calif. This machine is designed to take cuts along any



Pratt & Whitney multiple-station piston gage



Tyler band saw equipped with spiral cutting blade

To obtain additional information on equipment described on this page, see lower part of page 230.

line that can be drawn or scribed in such widely different materials as steel, plastics, and foam rubber. The new spiral blade presents a 360-degree cutting edge which will cut smoothly in any direction, enabling the operator to produce any pattern without turning the work.

The new planetary transmission provides a stepless, variable saw speed range of from 70 feet per minute, which is suitable for steel and other tough materials, up to 5000 feet per minute for cutting wood, aluminum, and other materials. An adjustment dial is provided for selecting the proper speed for cutting more than twenty-five different materials.

The band saw is 60 inches high, has a throat depth of 12 inches, and a clearance under the guide of 8 1/2 inches. The table tilts 45 degrees to the right and 5 degrees to the left. The saw is driven by a 1/3-H.P. heavy-duty, 110-volt electric motor. 86

Brown Ball Tilting Milling Table

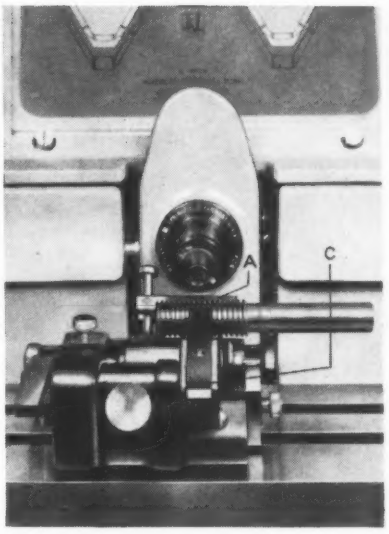
Leo G. Brown Engineering Co., 1531 S. Sunol Drive, Los Angeles 23, Calif., has added to its line of shop and tool-room equipment, a ball tilting milling table of radically new design. This table is made from fine-grain Meehanite semi-steel normalized castings. All parts are precision-machined and are held to close tolerances. The calibrated dials are hand engraved and the table-top surface is precision-ground.

The table top is 7 1/2 inches square and has 1/4-inch by 7/8-inch T-slots for 1/2-inch bolts. When in the level position, the over-all height of the table is 6 1/2 inches. The base index circle is calibrated through 360 degrees, the cross-feed slide has a travel of 6 inches; and the lower base of the table is 8 3/4 inches in diameter. The weight of the table is 50 pounds. 87

"Minute Man" Push-Broach and Collared Bushings

The du Mont Corporation, Greenfield, Mass., has announced an improved "Minute Man" production type keyway push-broach designed as shown in the upper view of the illustration. This broach can be used with either hydraulic or hand-operated arbor presses for multiple production of keyways in moderate quantities. It supports itself in the hole, no guide being necessary, and only one pass is required to complete a keyway of standard depth. Each broach is ground to fit the specified hole diameter. This push type broach is available in keyway widths of 1/32 to 1/4 inch and for different hole diameters.

The new du Mont "Minute Man" collared bushings, shown in the lower view of the illustration, are available in sizes of 1/4 inch to 1 9/16 inches for use with the "Minute Man" line of keyway broaches. Larger sizes are also available on special order. 88

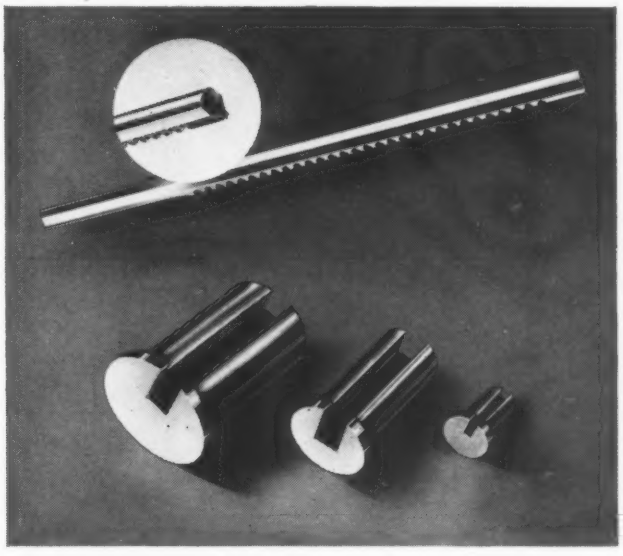


Jones & Lamson optical comparator equipped with new universal staging fixture for checking screw threads

Universal Staging Fixture for Jones & Lamson Optical Comparators

A universal staging fixture of new design has been brought out by the Jones & Lamson Machine Co., Springfield, Vt., for use on its optical comparators. The universal screw stage accurately checks the pitch diameter, lead, and angle as rapidly as the pitch diameter alone can be checked with a snap gage. It provides means for simultaneously comparing all the elements of the thread with a master gage, so that the lead for the whole length of the screw, pitch diameter, and thread angle, crest, root, and

Ball tilting milling table made by Leo G. Brown Engineering Co.



du Mont Push-through broach and collared broach bushings

To obtain additional information on equipment described on this page, see lower part of page 230.

taper can be checked at a glance. The enlarged shadow obtained with the comparator also reveals instantly any wear on the tool, chasers, rolling dies, or grinding wheel, not only detecting each individual error but also showing the cumulative effect of errors.

In use, a pair of rolls corresponding to the pitch of the thread to be inspected is mounted on the roll shaft, the fixed roll being spaced longitudinally from the center of the lens a distance equal to the length of engagement of the screw to be inspected. A master gage is then staged on the rolls. It is also supported by the adjustable back-stop shown at *A* in the accompanying illustration and the spring-operated clamp *C*. The enlarged shadow of the master thread is then made to coincide with the correct tolerance outlined on the chart, after which the master gage is replaced by the screw to be inspected.

The staging fixture, with four pairs of rolls, will accommodate screws from 3/16 to 1 inch in diameter, with pitches of 6 to 44, right- or left-hand. 89

Hammond Wet or Dry Carbide Tool Grinder

A Model WD-10 carbide tool grinder that can be used for either wet or dry grinding has been announced by Hammond Machinery Builders, Inc., Department GP-14, Kalamazoo 54F, Mich. For wet operations, the baffle plate and exhaust outlet of the grinder are turned to the "off" position and the coolant system is switched on. For dry operation, the coolant is turned off and the baffle plate and exhaust outlet are opened.

The two 10- by 19-inch tables have a removable steel wear plate and a table slot in which the compound protractor tool-gage slides. Openings are provided for coolant drainage. The tables are quickly adjustable to any angle from 15 degrees above to 30 degrees below the horizontal. The safety cup disk completely fills the open cup of the wheel and prevents injuries or dropping of tools into the cup of the wheels. Special guards, while permitting unrestricted vision, protect the operator and keep the floor dry. 90

Kent-Owens Milling Machine Equipped with Rotary Table

The Kent-Owens Machine Co., Toledo, Ohio, has brought out a milling machine equipped with a hydraulically controlled rotary table, 16 inches in diameter, in place of the standard table. The rotary table is driven by a gear and rack mounted at the rear of the fixture, the rack being actuated by a hydraulic cylinder. The desired machining cycle can be obtained by placing dogs in the proper positions on the outside of the rotary table.

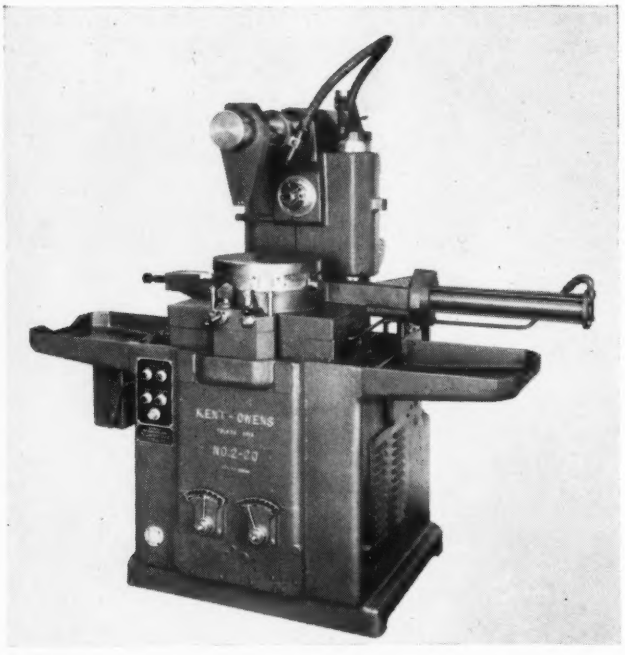
This No. 2-20 machine has twelve spindle speeds ranging from 64 to 860 R.P.M. The simple direct drive has only two gear contacts between the cutter and the ball-bearing motor at the rear of the machine. The drive from the motor is by a vertical splined drive shaft, worm and worm-wheel, through pick-off gears directly to the cutter. The head is mounted on two cylindrically ground steel posts with a spindle midway between them. 91

Bennett "Auto-Feed" for Centerless Grinders

The Bennett Equipment Co., 4725 Ellery, Detroit 7, Mich., has brought out a new "Auto-Feed" attachment for use on centerless grinders. This attachment permits the grinder to be operated either automatically or manually with a change-over time of less than two minutes. It can be installed quickly and is simple to operate.

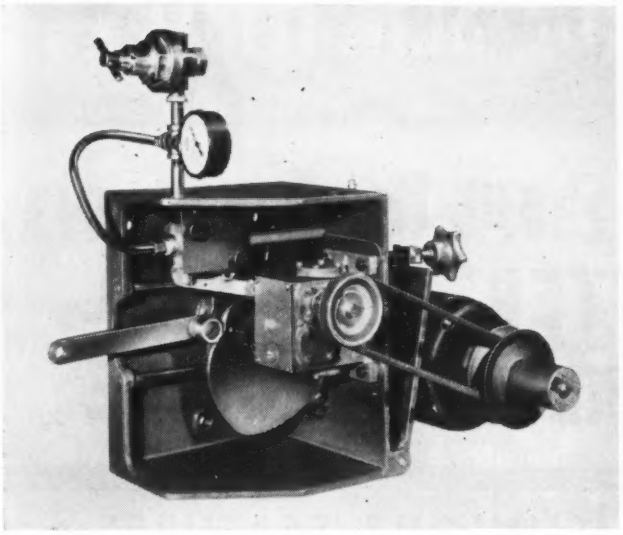
The automatic yoke of the attachment is secured to the worm-

Hammond carbide tool grinder for wet or dry grinding

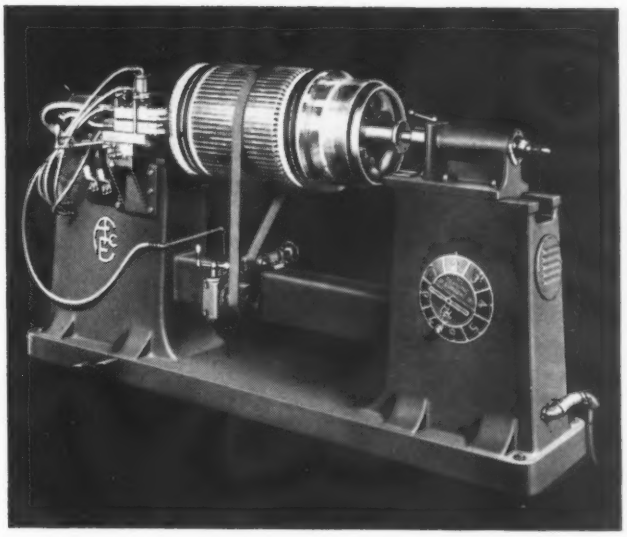


Kent-Owens milling machine with rotary table

To obtain additional information on equipment described on this page, see lower part of page 230.



"Auto-Feed" for centerless grinders brought out by the Bennett Equipment Co.



Brazing machine brought out by the American Electric Fusion Corporation

wheel, allowing the hand in-feed lever to remain on the grinder. Two reciprocating cams designed for accuracy and uniformity of feed actuate the drive arm. The air-operated ram ejects the work as each grinding operation is finished. Any tapered or shouldered piece can be handled by the "Auto-Feed" attachment. It is illustrated with the cover removed.....92

Stationary Brazing Machine

A new stationary brazing machine, designed to facilitate the brazing and silver soldering of electric generator and armature coil ends in repair shops, has just been announced by the American Electric Fusion Corporation, 2616 W. Diversey Parkway, Chicago 47, Ill. This machine will accommodate armatures from 18 to 42 inches in diameter and, with slight changes at the factory, it can be adapted for handling armatures of any size. The unit can also be used as a source of power supply for portable brazing equipment and for a number of other brazing and soldering applications.

This brazing machine has a built-in heavy-duty 24-KVA transformer with auto-regulating coil and eight-point heat control selector to provide efficient operation under exacting conditions, with a wide range of brazing heats for work of all sizes. All common forms of brazing alloys, such as foil, wire, strip, and powder, can be used. The machine is 49 inches high, 24 inches wide, and 99 inches long, and weighs 2400 pounds. 93

"Hydro-Finish" Blast-Cleaning Cabinet

A new "Hydro-Finish" cabinet has been developed by the Pangborn Corporation, 1406 Pangborn Blvd., Hagerstown, Md., for blast-cleaning precision machined parts by a modified form of impact blasting with an extremely fine abrasive suspended in liquid. Precision machined parts can be held to size within a tolerance of 0.0001 inch. There is no breakdown of sharp edges or corners, and the finish is non-directional, making the process especially suitable for use in the maintenance of dies and molds. Delicate instruments, wrist - watch cases, watch and clock gears, and fragile materials can be cleaned and polished successfully, as well as cutting tools after they have been finish-ground.

Pangborn "Hydro-Finish" blast cleaning and finishing cabinet

The process of "Hydro-Finishing" is performed in a watertight cabinet provided with a hopper tank for mixing, storing, and re-collecting the suspension liquid. Abrasive particles as fine as the equivalent of 5000 mesh are in common use. By varying the abrasive particle size and hardness, air pressure, distance of gun from work, and liquid-abrasive ratio, or any combination of these factors, it is possible to obtain almost any desired finish. 94

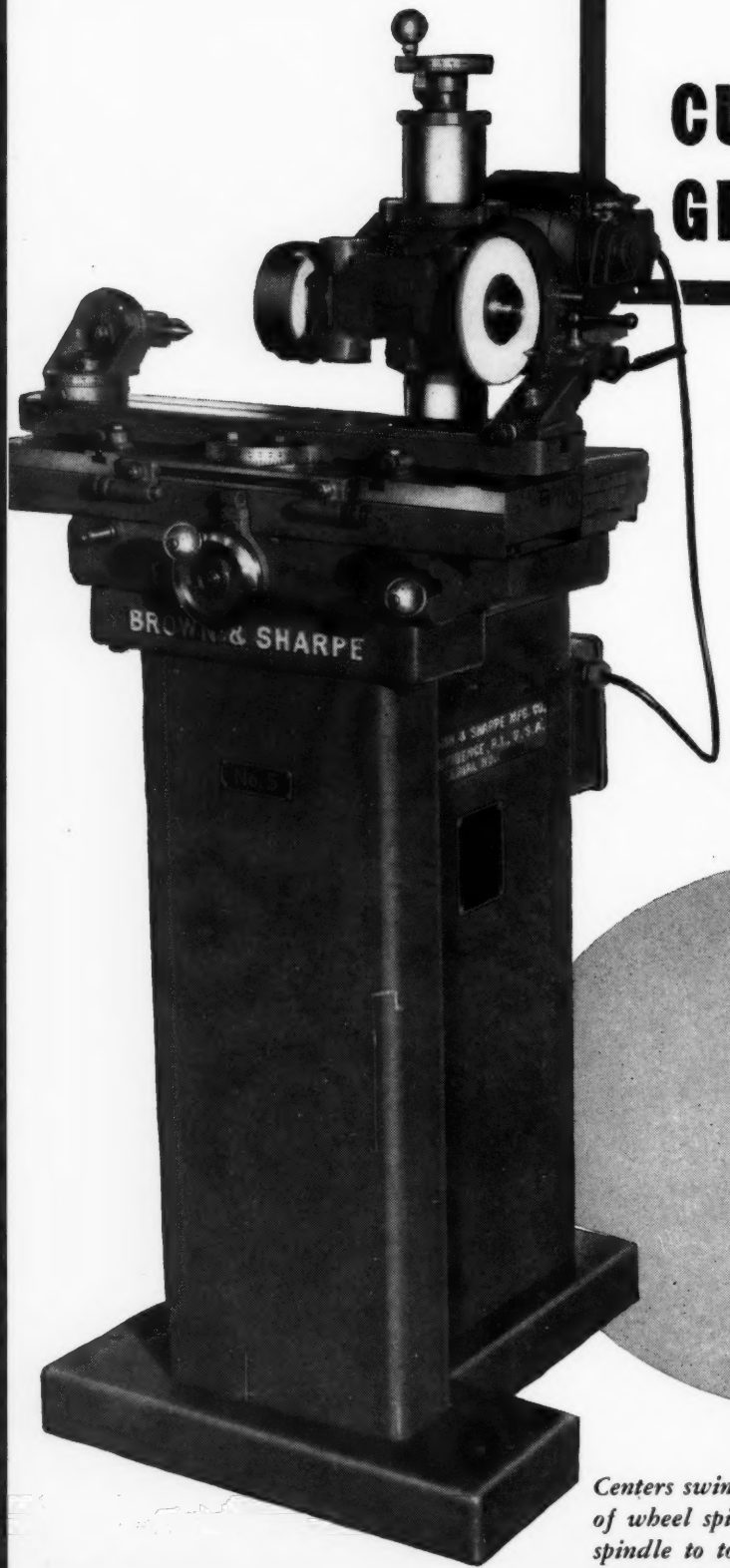
Wyco Grinder Hand-Piece with Speed Step-Up — Correction

In the description of the step-up hand-piece brought out by Wyzenbeek & Staff, Inc., 838 W. Hubbard St., Chicago 22, Ill., which appeared on page 238 of February MACHINERY, mention

To obtain additional information on equipment described on this page, see lower part of page 230.

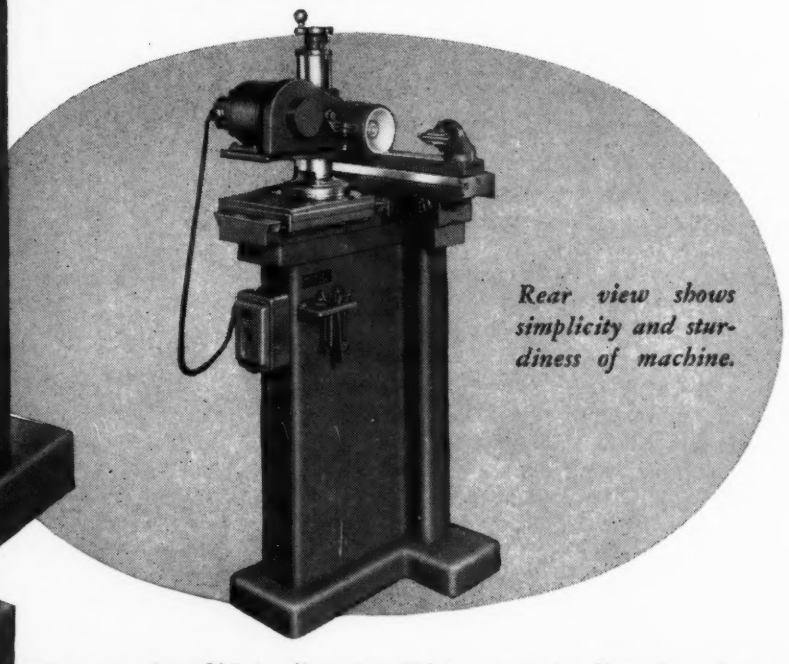
DESIGNED FOR UNIQUE SENSITIVITY . . .

THE No. 5 CUTTER AND TOOL GRINDING MACHINE



UNIQUE FEATURES

- √ **Double-ended ball bearing wheel spindle (super-precision, permanently-sealed, grease-lubricated bearings).**
- √ **Ingenious, roller-bearing table.**
- √ **4-location table crank or knob.**
- √ **Hollow, one-piece base, mounted on 3 points to preserve alignment.**
- √ **Additional equipment: Indexing equipment; Raising Blocks; Formed Cutter Sharpening Equipment; Collets for No. 5 & No. 7 B & S Taper Shanks; Draw-in Bolt; 3/8" and 3/4" Cutter Bars.**



Rear view shows simplicity and sturdiness of machine.

Centers swing 6 3/8" in diameter. Distance, center line of work to center of wheel spindle, greatest 8 1/8", least, 1 5/8". Distance, center of wheel spindle to top of table, greatest, 6 7/8"; least, 1 3/8". Write for complete specifications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BROWN &

TO SPEED SMALL-CUTTER SHARPENING

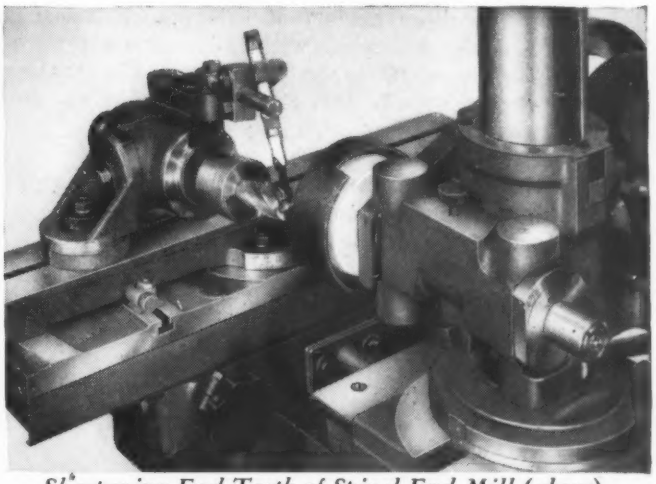
NEW OPPORTUNITIES

are now available for important improvements in your tool room efficiency through the compact, versatile and extremely sensitive Brown & Sharpe No. 5 Cutter and Tool Grinding Machine. It is specifically designed to handle a large share of tool room sharpening jobs . . . all types of small cutters, especially end mills . . . also reamers and similar tools. Handy in size and unusually flexible, it simplifies and speeds up cutter and tool sharpening.

Easy-gliding, roller-bearing table makes operation extremely simple and accurate.

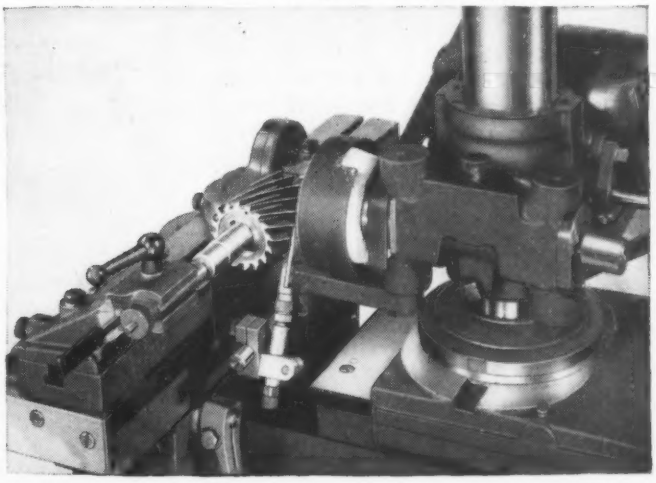
✓ SAVE ON SET-UPS AND OPERATION

The super-sensitive operation of this No. 5 machine . . . readily responsive to a light touch from the operator . . . makes set-ups and operation fast and easy. It is the result of an ingeniously-designed table which slides on 36 precision-ground rolls . . . plus lighter weight parts, engineered for fast and accurate sharpening. Most desirable work center height, conveniently located controls, and small machine size also facilitate set-ups and operation.



Sharpening End Teeth of Spiral End Mill (above).

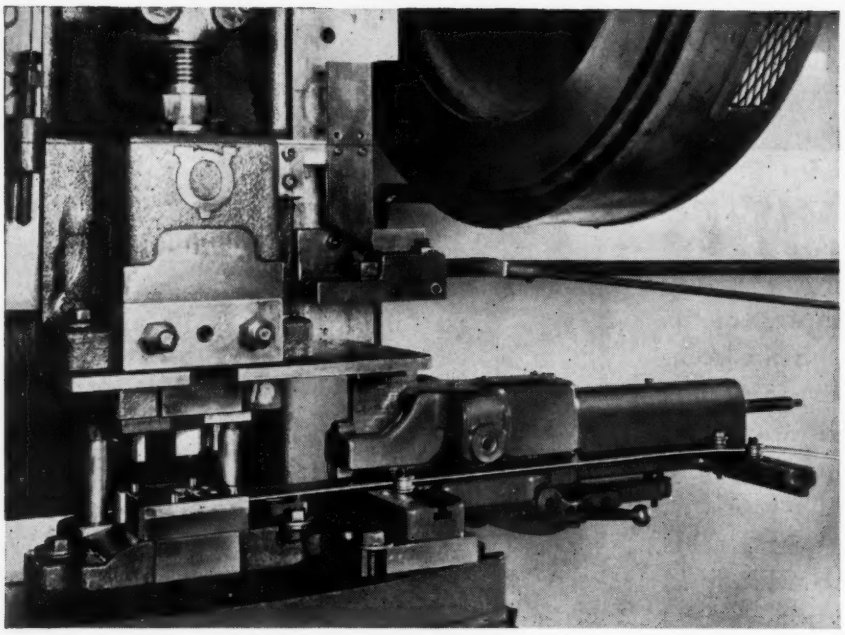
Sharpening Plain Milling Cutter (below).



✓ SAVE ON FLOOR SPACE AND INVESTMENT

For a moderate investment, the No. 5 Machine will do much of the work that has been done frequently on larger, more expensive machines. On the basis of smaller overhead and space alone, it will reduce the unit cost of sharpening many cutters and tools.

SHARPE B·S



Press equipped with Dickerman automatic "Rol-Di-Feed" stock feed

should have been made that this device could be used with all Wyco flexible-shaft type grinders to increase speeds three times. In the original description, it was stated that by means of this gear step-up, speeds up to 5000 R.P.M. or higher can be obtained for 1/4-inch mounted wheels, carbide cutters, rotary files, abrasive rolls, etc. Instead of 5000 R.P.M., this should have read 33,000 R.P.M...95

Dickerman Automatic Punch Press Feed

An automatic punch press feed known as the "Rol-Di-Feed" has just been developed by the H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass., to retain the advantages of the hitch and die feeds made by the company, and yet provide increased range and versatility. This cam-driven feed can be easily installed on the press bolster or mounted directly on the die-shoe for feeding stock in any direction.

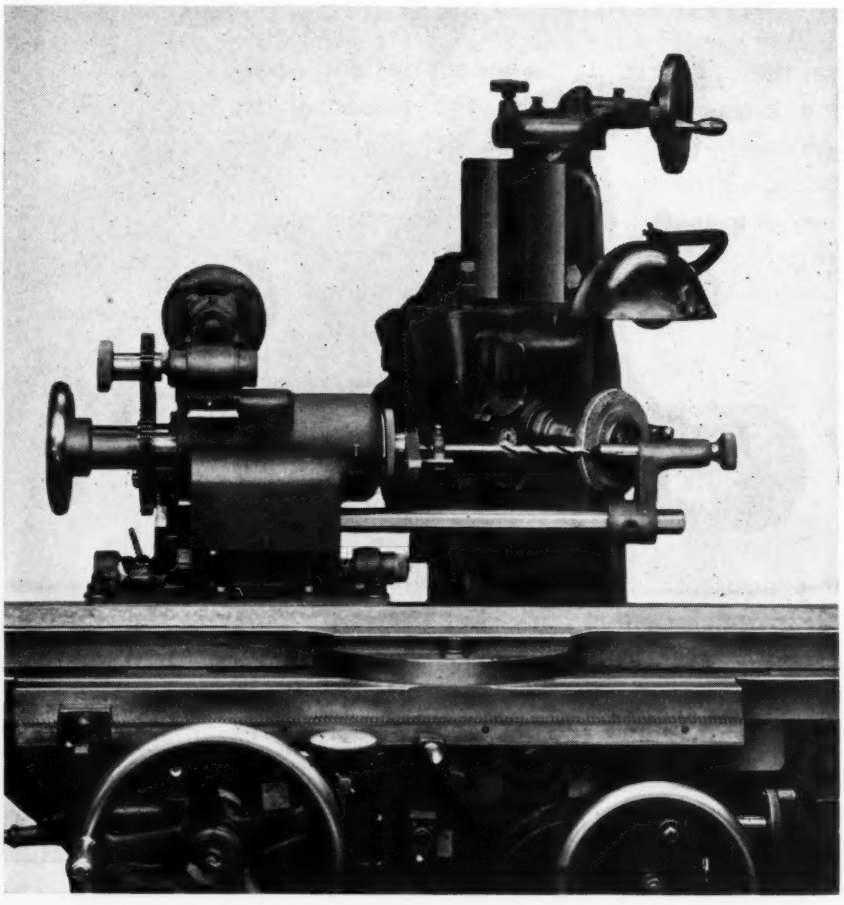
When set to continue the feeding action throughout most of the 360 degrees of press shaft rotation, the stock is advanced over the die at a relatively slow speed, resulting in increased accuracy, especially when using piercing and blanking dies and compound or progressive dies operating at high speed. The feed is also adapted for use with deep-drawing or forming dies, where only a small part of the stroke is available for feeding purposes.

The maximum feed length is 9 inches on presses having a stroke of 3 inches or more, and approximately three times the stroke for presses having strokes under 3 inches. Length of feed is adjustable in increments of 0.001 inch. The attachment is 22 inches long, 12 inches wide, 7 inches high, and weighs 100 pounds.....96

Glenbard Spiral and Radial Relief-Grinding Fixture

A new relief-grinding fixture designed for "on-center" grinding of spiral- and radial-relieved cutting tools has been developed by Glenbard Tool Manufacturers, Inc., 216 N. Clinton St., Chicago 6, Ill. This "Spi-Rad" relieving fixture, as it is called, can be easily mounted on any universal tool grinding machine, and is so simple to use that it can be operated by an unskilled worker. It will grind adequate clearance on practically every type of spiral- and radial-relief cutting tool, removing only a minimum of stock behind the cutting edges.

Cutters with any number of



Glenbard "Spi-Rad' relieving fixture developed for use in grinding cutters having spiral and radial relief

To obtain additional information on equipment described on this page, see lower part of page 230.

Passed from hand to hand, the work progresses from blank at right to completed part at extreme left. Two punching and notching and two forming operations are performed at each stroke of the press.

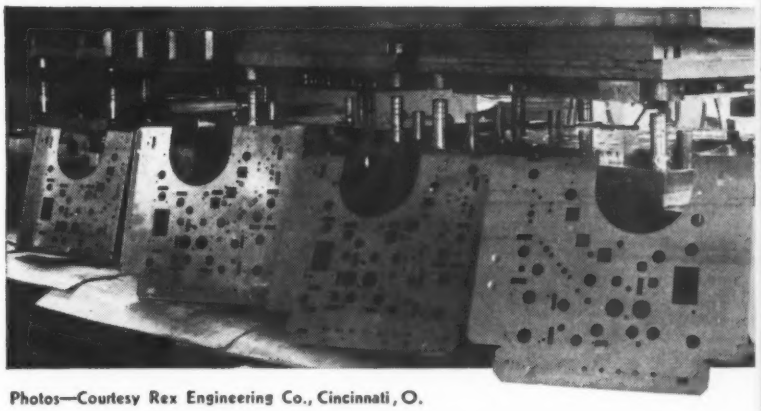
OPERATION TELEVISION...

This television chassis, a modern product made in the modern manner on a Cincinnati Press Brake, is produced from blank to completion in one stroke—four simultaneous operations on one machine.

281 holes, tabs and notches are punched, and three sides are formed at each stroke—to close tolerances.

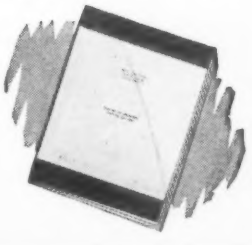
Cincinnati wide beds and rams—either fixed or detachable—for large area work, are highly productive on jobs of this kind.

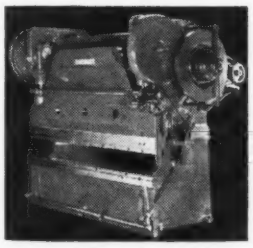
You may find you can do it for less on a Cincinnati Press Brake.



Photos—Courtesy Rex Engineering Co., Cincinnati, O.

Write for technical Bulletin 135 a compact treatise on Press Brake practice, dies and applications.





THE CINCINNATI SHAPER CO.

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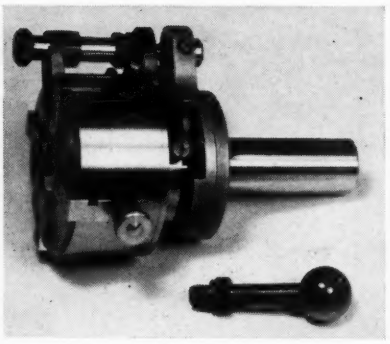
flutes from one to six can be accommodated by a simple change of gears. Tools can be cylindrically ground either in the collet or between centers by simply disengaging the relief-actuating mechanism. After the form has been ground, the relief-actuating mechanism is re-engaged and the tool relieved without removing the fixture from the machine.

Work up to 1 inch in diameter can be accommodated in the draw-bar collet, and an adapter facilitates the use of a chuck or faceplate. Tools up to 4 1/2 inches in diameter by 12 inches long can be handled between centers, and by adding the collet type chuck or faceplate, larger end-cutting tools can also be relieved.

The back-plate mechanism that contains the cam assembly which gives the fixture the motions required for helical- or spiral-relief grinding is attached to the main body of the fixture, which has a base designed for mounting on the grinding machine. One of the change-gears which give the required indexing is mounted on the same stud with the cam. On the back side of the main body is a sine bar which can be adjusted to give the required amount of radial or diametral relief. Another sine bar mounted on the left side of the base can be adjusted to give the required helical or spiral relief.

In operation, the back-geared motor drives the spindle gear which, in turn, drives the cam and indexing gear. With each rotation of the cam, the fixture is moved or pivoted forward. The amount of pivoting can be adjusted by one of the sine bars to give the required amount of spiral relief. By adjusting the other sine bar the amount of radial relief can be controlled. 97



Aligning-shank convertible die-head brought out by the Geometric Tool Co.

Geometric Aligning-Shank Convertible Die-Head

Correct alignment between work-spindle and die-head chasers is essential for the production of accurate screw threads. This sometimes necessitates providing some means of compensating for misalignment due to worn spindle bearings. To meet such needs, the Geometric Tool Co., Blake and Valley Sts., New Haven 15, Conn., has placed on the market a new Style DS convertible self-opening die-head which has a built-in aligning shank. This aligning shank provides the means for quick centralizing of the die-head for the work when misalignment exists in the machine. The new die-head is available from stock in sizes up to and including 3/4 inch. 98

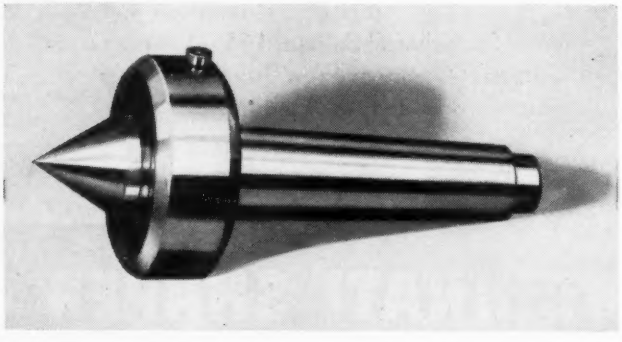
South Bend Ball-Bearing Live Center for Lathes

A precision live center designed to provide the strength and rigidity required for heavy roughing cuts and the accuracy necessary for fine work and high speeds is a new product of the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind. The revolving center is made of electric-furnace tool steel heat-treated to a hardness of 61 to 65 Rockwell C. The center point shaft extends through the taper shank and is supported by bearings at both ends. A specially designed precision ball bearing carries both radial and thrust loads, and center-point whip is eliminated by a rear pilot bearing. All parts are interchangeable and replaceable. This live center is available in two sizes having No. 2 and No. 3 Morse taper shanks. 99

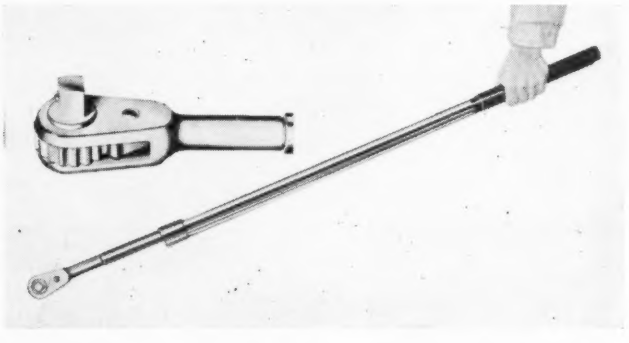
Light-Weight Heavy-Duty "Livermont Torq-Bar"

Richmont, Inc., 2810 E. Eleventh St., Los Angeles 23, Calif., has added a new heavy-duty, light-weight "Livermont Torq-Bar" to its line of torque wrenches. This torque bar is available with or without detachable heads or with special heads. The standard head is a reversible 3/4-inch square drive ratchet type which operates in either direction. The bar can be set for torques from 200 to 600 foot-pounds. When the pre-set torque is reached, a loud "click" is heard, and simultaneously a small button in the handle taps the operator's hand, thus giving both sound and touch signals.

The bar and head are made of chrome-molybdenum steel, the bar being chrome-plated and provided with a rubber-cushioned handle wrapped with plastic tape. The truss rod is made of stainless steel. The total weight of the bar and head is 8 pounds 6 ounces, and the length of the assembled bar and head is 52 inches.....100

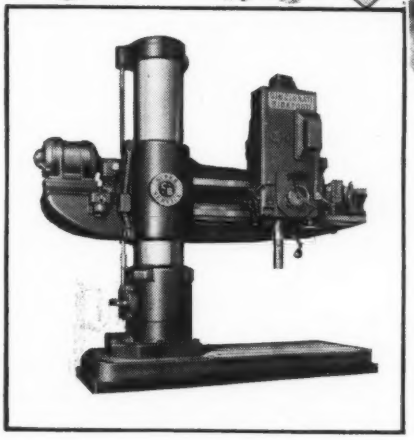


Ball-bearing precision lathe center manufactured by the South Bend Lathe Works



Light-weight, heavy-duty signalling type "Livermont Torq-Bar" brought out by Richmont, Inc.

To obtain additional information on equipment described on this page, see lower part of page 230.



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The smooth, chatterless, powerful and durable drive of the Cincinnati Bickford Super Service Radial Drill is a success factor in every job you do.

Driven by 10 splines machined from the solid, the driving gear is mounted on a special continuous bronze alloy sleeve which is carried by anti-friction bearings mounted on close centers.

Herringbone, continuous tooth gears are used for the lower speed ranges—for strength and smooth-rolling action.

The large continuous tooth gear never exceeds 500′ peripheral speed a minute, automatically declutches at high speeds and eliminates strains of flywheel inertia on high speeds and on spindle reverse.

Such design and engineering give Cincinnati Bickford Super Service Radial Drills great accuracy and a long life of trouble-free operation.

Write for the detailed bulletin No. R-29 for complete data.

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Equal Efficiency of Every Unit Makes the Balanced Machine

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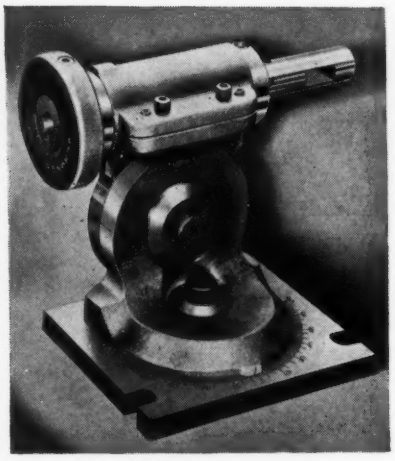
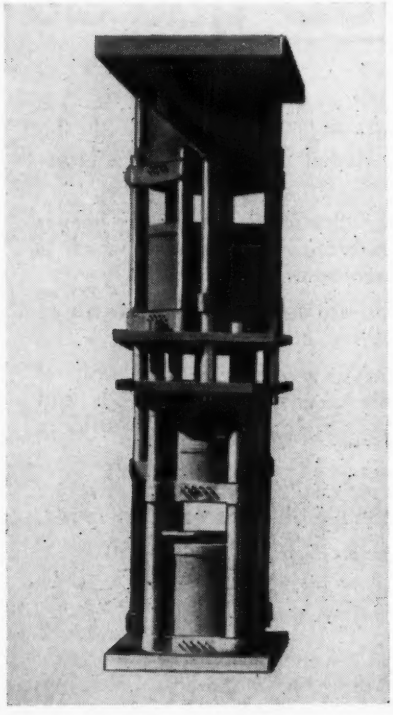


Madison Grinding Fixture

Low-priced cutter grinding fixture suitable for handling a large number of precision grinding jobs, announced by Madison Mfg. Co., Muskegon, Mich. Originally designed to facilitate the regrinding of Madison cutters, this fixture has now been modified to accommodate a variety of shop grinding jobs. It has been used to grind cutting edges, steps, flutes, and chip relief on milling cutters, chamfering tools, turning tools, and reamers. The fixture is graduated in degrees for adjustment in all three planes. It provides automatic indexing where indexing movements up to 180 degrees are required. 101

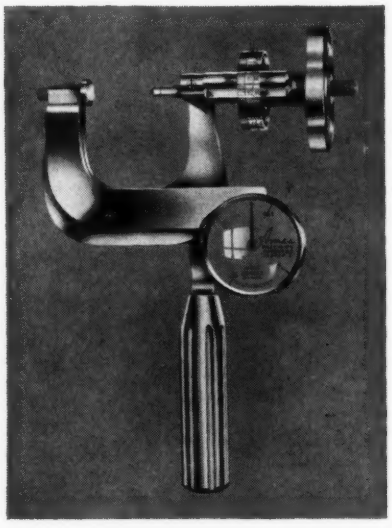
Dayton Rogers Heavy-Duty Die Cushions

New large die cushion being manufactured by the Dayton Rogers Mfg. Co., Minneapolis 7, Minn., which has an over-all ring-holding capacity of 360 tons when operated at an air-line pressure of 100 pounds per square inch. The four-cushion units, such as the one shown, are mounted on a large straight-sided 2000-ton power press. Can be used in all deep-drawing operations, and are well adapted for controlling die pressure pads on forming dies, as well as for use with ejector mechanisms if required. Can be operated as individual units on a given press or piped in series to provide a constant ring-holding pressure on all four units when desired. 102



Ames Hardness Tester

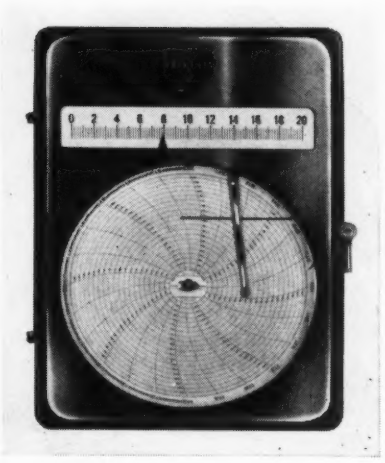
Model 2 hardness tester brought out by the Ames Precision Machine Works, 131 Lexington St., Waltham 54, Mass., for testing the hardness of dies, knives,



cutters, saws, gears, round and flat stock, tubing, and odd-shaped parts in sizes up to 2 inches, for which the smaller Model 1 tester does not have the required capacity. With these hardness testers, pressure is applied to the penetrators by screw action. The tests are made directly in the Rockwell scales with the penetrators and pressure loads specified in the Rockwell conversion chart. The tester employs reversible anvils and penetrators; special anvils and larger ball penetrators can also be supplied. 103

Bristol Time-In-Process-Recorder

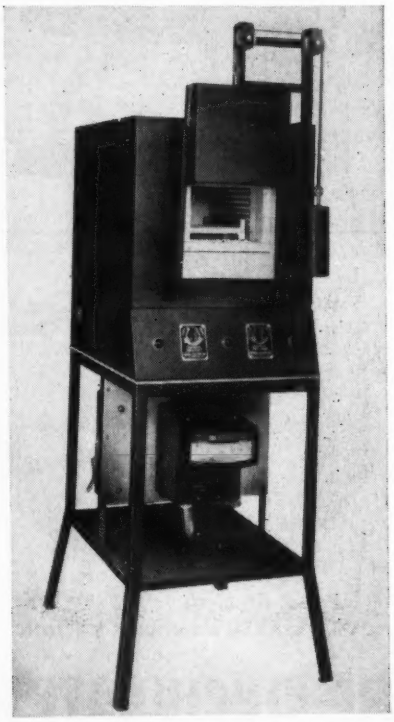
New instrument designed for recording the time required for machining or processing work, announced by the Bristol Co., Waterbury 91, Conn. This instrument gives a reading on a uniform scale and chart of the rate of conveyor movement directly in terms of the total time consumed while the work is being processed, no calculations being required. This simplifies the problem of establishing the correct conveyor speed



for the desired time in process for a given product and assists in eliminating errors. Used on such equipment as continuous furnaces for metal annealing, tempering, hardening, continuous drying, and baking. 104

Electric Furnace with Accurate Temperature Control

New floor model electric furnace equipped for accurate temperature control over the entire range from room temperature up to 2000 degrees F. Introduced by the K. H. Huppert Co., 6830 Cottage Grove Ave., Chicago 37, Ill. Designed specifically for heat-treating tools and dies, including hardening and drawing. Can also be used in the chemical laboratory for ash analysis. The inside dimensions of the furnace are 8 inches wide, 6 inches high, and 12



To obtain additional information on equipment described on this page, see lower part of page 230.

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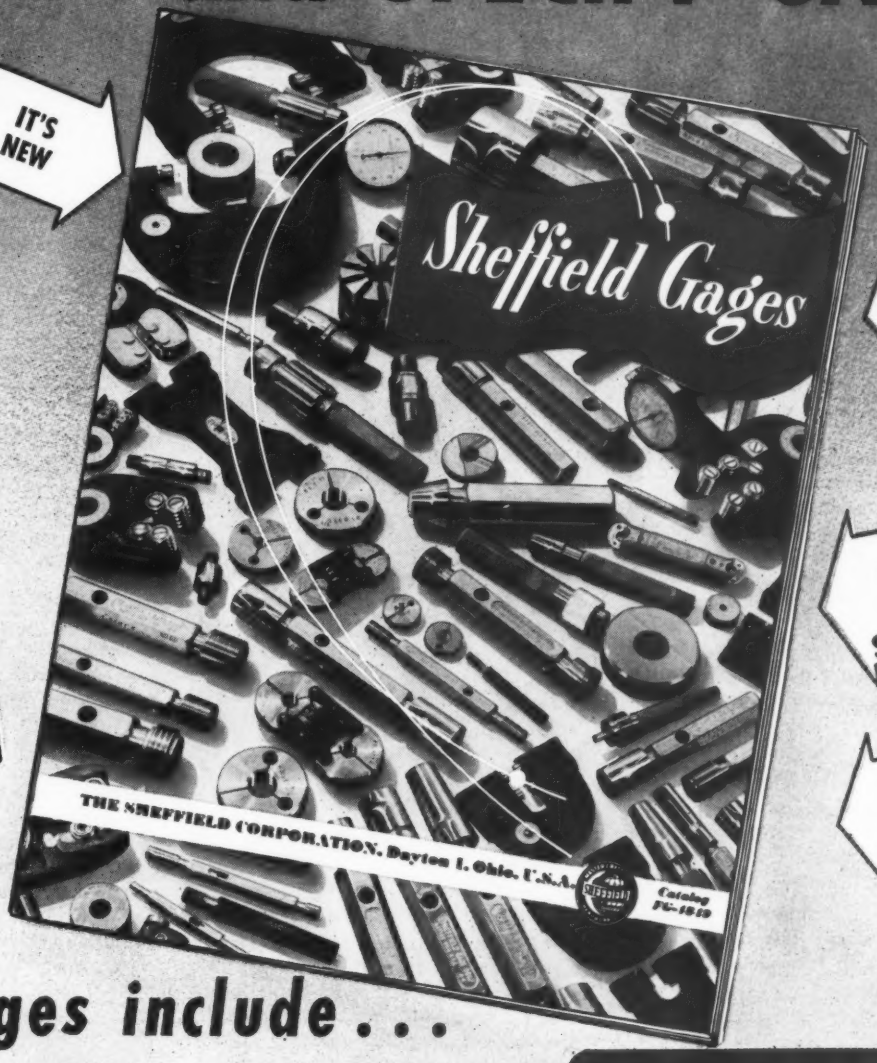

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- Reversible Cylindrical Plug Gages
- AGD Snap Gages and Length Gages
- Special Gages of all Types

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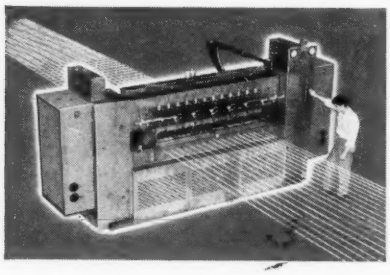
Dayton 1, Ohio, U.S.A.

inches deep; over-all dimensions are 24 inches wide, 29 inches deep, and 68 inches high for the floor model. Operation on 220-volt, single-phase current is preferable, but can be furnished for operation on other currents. The current consumption is 4 kilowatts. 105



Sciaky Special Wire Welding Machine

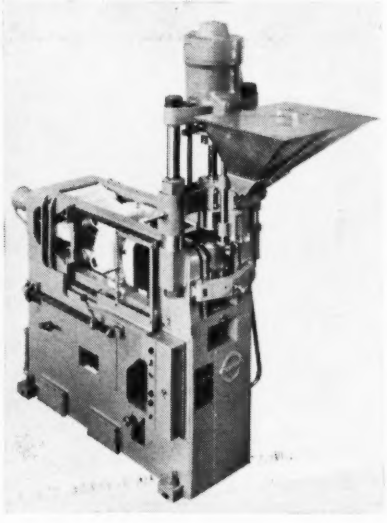
Special welding machine built by Sciaky Brothers, Inc., 4915 W. 67th St., Chicago 38, Ill. Contains twelve welding pressure heads with die-blocks, each arranged for welding one or more wires simultaneously. Longitudinal wires 1/16 inch in diameter, spaced 1/4 inch center-to-center, for example, can be joined to cross wires 5/16 inch in diameter with 1/2 inch center-to-center spacing. The machine can be set up for welding wires with wider spacings up to a maximum of 12 inches. Cross wires are loaded automatically, and longitudinal wires are indexed automatically by an adjustable spacing arrangement. 106

Ruthman Gusher Pumps with Explosion-Proof Motors

Explosion-proof polyphase motor for gusher pumps, available in 1/4-, 1/2-, and 3/4-H.P. sizes. These motors are suitable for use in hazardous locations, and have passed the Underwriters Laboratory Test "Class 1 Group D." In the application illustrated, a Model UL-7124-EXP motor is shown installed on a totally enclosed portable tank. This unit, with 1/4-H.P. explosion-proof motor, was developed for pumping highly volatile liquids. Numerous other applications of these motors can be made on gusher pumps handling various liquids testing up to 150 seconds Saybolt viscosity at 100 degrees F. Developed by the Ruthman Machinery Co., 1807 Reading Road, Cincinnati 2, Ohio. 107

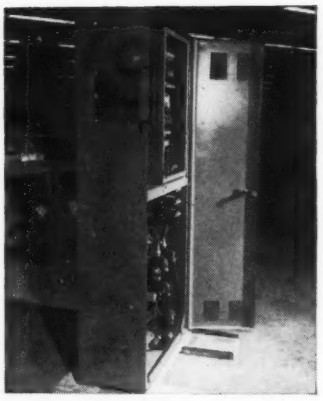
Lester Injection Molding Machine for Plastics

New 4-ounce injection molding machine for plastics, announced by Lester-Phoenix, Inc., 2711 Church Ave., Cleveland 13, Ohio. This L-1/2-4 machine has an internally heated cylinder of exceptional plasticizing capacity; can be operated at a speed of 600 cycles per hour; and will apply pressures up to 20,000 pounds per square inch, as required for molding nylon. Features include patented toggle links, central die adjustment, large adjusting screw, and semi-automatic operation. The dies have been designed to reduce scrap salvage problems to a minimum, and can be easily changed. 108



Westinghouse Single-Phase Control for Resistance Welding

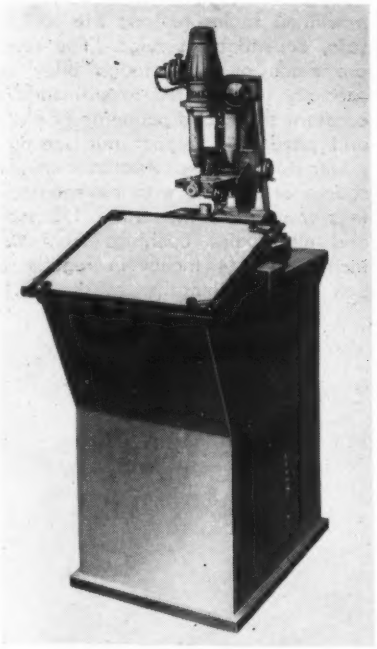
Single-phase to single-phase, low-frequency, electronic welding control with a lower KVA demand and a higher power factor than standard single-phase to single-phase controls. Available from the Westinghouse Electric Corporation. P. O. Box 868, Pittsburgh 30, Pa. This control makes possible welding of scaly or rusty steel with a minimum of "spitting" from the electrodes, and can be used for welding brass or aluminum. Designed for connection to a resistance welding machine having a specially constructed transformer with a center tapped primary winding. Operation of the control is such that current is passed in one direction through the primary for four half-cycles, stopped, and then reversed for four half-cycles, thus producing a low-frequency alternating current on the output side of the transformer. Electronic circuits accurately control the duration of each of these half-cycles. 109



Matco Wheel Dresser

Diamond wheel dresser for surface and external grinders that eliminates the necessity for stopping and starting machine, removing and replacing work, or lowering and raising wheel-head in dressing. Can be easily mounted on a grinding wheel guard and aligned by leveling screws, using a surface gage and indicator. Take-up screws are provided for both horizontal and vertical feed-screws. Made for truing wheels up to 1 3/8 inches wide, but can be provided for wheels up to 3 inches wide. Has vertical adjustment of 1 1/2 inches. Manufactured by Matco Tool Co., 2830 W. Lake St., Chicago 12, Ill. 110

To obtain additional information on equipment described on this page, see lower part of page 230.



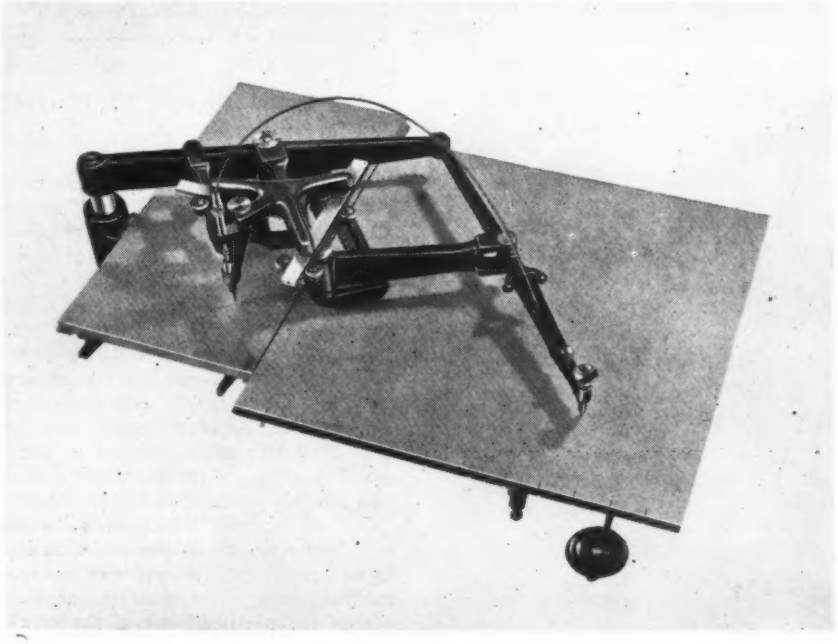
Hauser Profile Projector

New type profile projector designed to permit precision parts to be quickly checked and measured at magnifications of 10, 20, 50, and 100X, any magnification being obtainable by simply twisting the turret so that the required lens snaps into place. The magnification slide also snaps automatically into place in accurate alignment with lens. Gears, hobs, milling cutters, cams, components of small arms, profile gages, watch parts, etc., can be easily checked and measured. Reading accuracy on the screen is about 0.004 to 0.008 inch, which at a magnification of 100X, corresponds to an error on the part of 0.00004 to 0.00008 inch. Available from Hauser Machine Tool Corporation, Manhasset, N. Y., representative in the United States of Henri Hauser, Ltd., Bienne, Switzerland. 111

Niagara Foot-Operated Squaring Shears

One of a new line of foot-operated squaring shears brought out by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y. These shears combine increased strength and rigidity with light weight and easy action. They are fabricated completely from steel. The rigid one-piece weldment, comprising the bed and the deep cross-head guided in flat bronze ways,

provides non-deflecting support for the knives, which results in accurate, clean, square cuts. Available in 30-, 36-, 42-, and 52-inch widths. 112



Mead Impact Air Hammer

Impact air hammer announced by Mead Specialties Co., Department IH26, 4114 N. Knox Ave., Chicago 41, Ill. This new Model 105 hammer has a height of 44 1/8 inches; throat depth of 4 1/2 inches; maximum daylight opening of 18 inches; maximum stroke of 8 inches; a capacity of about 15,000 pounds at point of impact; and a table with a working surface of 7 by 9 inches. ..113

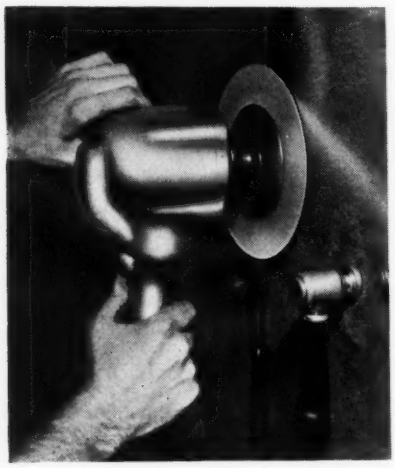
"Perspector" Isometric Drafting Machine

Compound pantograph drafting machine, known as the "Perspector," developed to facilitate production of ink or pencil isometric drawings by a comparatively simple process of tracing ordinary plan and elevation drawings. The compound pantograph link system enables true isometric ellipses to be drawn by tracing circles, and the sliding arrangement of the isometric drawing board permits rapid drawing of vertical lines that are foreshortened to the proper isometric scale. Plan and elevation drawings to be traced are mounted on large fixed board shown at right. The isometric drawing is made on smaller slidably mounted board at left, and is drawn to one-half the scale of the drawings traced. Radius-bars, templets, and straightedges of transparent materials are available for use in guiding stylus while tracing plan and elevation drawings, making it possible to obtain very accurate isometric drawings much more rapidly than with conventional projection methods. This equipment is being introduced in the United States by the Omerex Precision Products Corporation, Chrysler Bldg., 405 Lexington Ave., New York 17, N. Y., representative for Isometric Projections Ltd., The Green, Newport Pagnell, Bucks, England. ..114

To obtain additional information on equipment described on this page, see lower part of page 230.

Buckeye Medium-Duty Sander

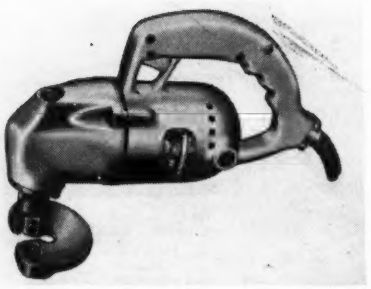
Medium-duty sander, manufactured by Buckeye Tools Corporation, Dayton 1, Ohio, is shown being used to line up the doors of a safe. This operation is typical of the many uses to which this light-weight, compact, portable tool is adapted. The sander weighs only 8 pounds 7 ounces and has an over-all height of 7 inches. It is also available



for use as a grinder with cup type counterbored center wheels and cup wire brushes. Made in five free speeds ranging from 4500 to 8500 R.P.M. 115

Black & Decker "Porto-Shear"

New 12-gage shear recently added to the line of "Porto-Shears" made by the Black & Decker Mfg. Co., Towson 4, Md. This tool will cut 12-gage standard sheet steel or about two gages thinner in Monel metal and stainless steel and approximately 50 per cent thicker sheet copper, aluminum, lead, and other nonferrous metals. The shear will easily



follow an irregular pattern, the cutting blade always being visible. It will cut on a radius as small as 1 1/2 inches, rapid reciprocating action of the vertical blade against a stationary horizontal blade making a clean smooth cut without burrs or ragged edges on either piece. The Black & Decker universal motor develops 1100 strokes per minute. 116

Williams Impact "Supersockets"

One of over 150 styles and sizes of impact sockets recently added to the "Supersocket" line manufactured by

J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y. The sockets in this line are adaptable to all socket locking methods used on the various types and makes of power and impact wrenches. They are accurately fitted and precision machined to insure long life and give safe, dependable service. The sockets are made of extra tough alloy steel specially heat-treated to withstand the constant shock and pounding of electric and pneumatic impact nut setting or power nut running. Available in seven square drive sizes with hexagon openings from 3/16 inch to 3 1/2 inches and eight-point openings from 5/16 inch to 1 1/4 inches in regular and bolt clearance lengths. 117

Die-Filer with Instantly Adjustable Stroke

Die-filer with 8 1/2- by 8 1/2-inch hard chromium-plated table which can be tilted 15 degrees front and back, using degree-graduated plate for settings. Height to top of table is 10 1/2 inches. Length of stroke is variable from 3/16 to 3/4 inch. Standard 1/8- or 1/4-inch diameter files 3 1/4 inches long are recommended. Ball-bearing equipped throughout, with all working parts lubricated by an internal reservoir having a transparent oil gage. A 1/6- or 1/4-H.P. motor is required for the drive. Made by the General Pacific Corporation, 1501 E. Washington Blvd., Los Angeles 21, Calif. 118

"Precisionaire" Machine for Checking Crankshafts

Gaging machine with twenty "Precisionaire" tubes, developed by the Sheffield Corporation, Dayton 1, Ohio, for accurately checking size and out-of-roundness of automobile crankshafts. The five main bearings are checked simultaneously with five "Airsnaps," each having three sets of jets which gage the work midway between the flanges and at a distance of 1/8 inch from each flange. The "Airsnaps" are so mounted that they can move forward or backward to allow for misalignment due to any possible warpage in the crankshaft. Two additional "Precisionaire" jets simultaneously check the seal diameter at one place and the width of the rear main bearing. The diameter at each end of the pin bearing and the break-

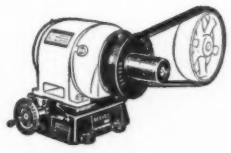
To obtain additional information on equipment described on this page, see lower part of page 230.

"No, no, Bascom! Just a screwdriver!
This machine is Reeves-equipped!"

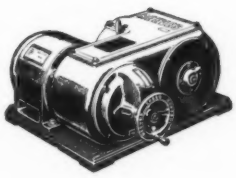
THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



Maintenance of machines equipped with REEVES Speed Control requires no special tools—no special training. REEVES units incorporate an operating principle proved in more than 260,000 installations. Simplicity of design and rugged construction throughout, with all working parts easily accessible, assure low-cost, trouble-free service. And on the job, REEVES Variable Speed Drives give you smooth, instant speed changes—provide *exactly* the right speed for every job under every changing condition. Result: increased production . . . improved, uniform quality . . . lower production costs. Install REEVES Speed Control on machines now in service—specify "REEVES-equipped" whenever you buy new machines.

• • •

FREE! A new, 16-page handbook no production man should be without, entitled "REEVES Automatic Production Control." Contains comprehensive information on the application of automatic production control to many different machines, under widely varying conditions. Write today for Catalog No. M19-G487.

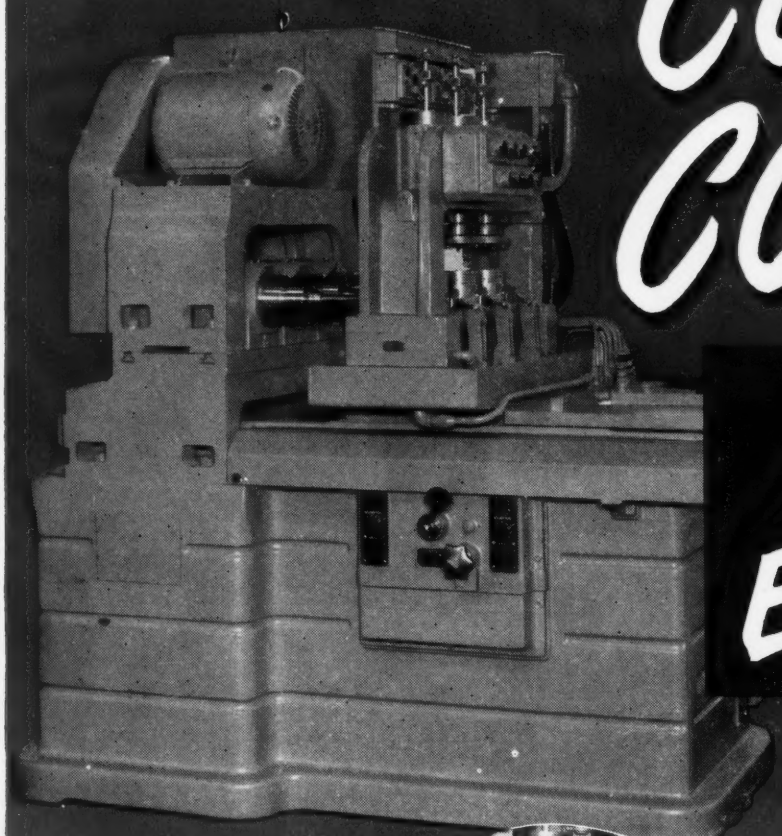
REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE
Reeves Speed Control
GIVES THE RIGHT SPEED FOR EVERY JOB!

WANT TO CUT COSTS?

SEE EX-CELL-O!



For Example:

Ex-Cell-O Standard Machine with High Production Fixture—Bores Piston Wrist Pin Holes with .0003" Tolerance at Net Rate of 211 Pieces per Hour!

To right: Fixture on Ex-Cell-O 112-C Precision Boring Machine provides hydraulic locating and clamping. Operation is tied in with machine cycle. The addition of two interchangeable sets of lower work centers and locating pins adapts the fixture for the whole group of pistons.

The Precision Boring Machine shown to left above (Ex-Cell-O Style 112-C) bores piston wrist pin holes at a rate of 211 pieces per hour, holding a tolerance of .0003" on the bore diameter, and providing a fine surface finish. The high production fixture accommodates a wide variety of similar pistons. Ex-Cell-O machines like this are also widely used for precision turning, facing and grooving operations. If your production involves parts like this, call your local Ex-Cell-O representative, or write Ex-Cell-O in Detroit today!

EX-CELL-O CORPORATION

49-9

XLO EX-CELL-O for PRECISION

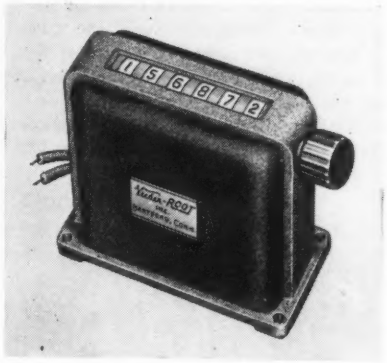
DETROIT 32, MICHIGAN

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

down of the radius at the cheeks are checked manually with an individual "Airsnap" having three sets of jets. 119

Veeder-Root Magnetic Counter

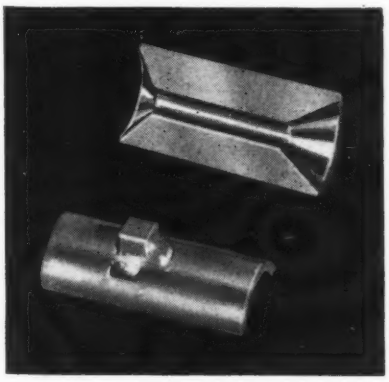
Magnetic counter of reduced size with compact, streamlined case, which is easily adapted to built-in installations. Brought out by Veeder-Root Inc., Hartford 2, Conn. This magnetic counter has few working parts, and is especially applicable for remote indication from



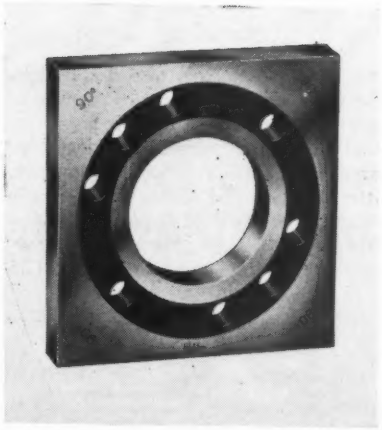
plant to office. Direct-reading line of six large figures in windows, brought out by contrasting background of light gray makes reading easy at some distance. Operates on 110-volt, 50- to 60-cycle current. 120

Solid Kennametal Feeding Pads

Cemented-carbide feed-finger pads made by Kennametal, Inc., Latrobe, Pa., for use in master feed-fingers of Brown & Sharpe, Hardinge, and Davenport automatic screen machines. These pads provide a high degree of wear resistance and non-galling properties. They are designed to assure positive feeding, give



exceptionally long service, and eliminate marring of stock. Available with internal diameters ranging from 9/32 to 1 1/16 inches. 121



Webber "True Square" for Indexing Operations

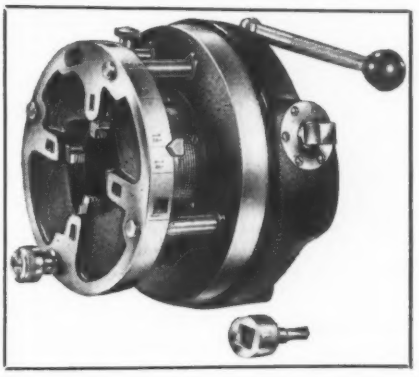
Device known as a "True Square," designed primarily for precision indexing, but adaptable to many tool-room uses. All faces of the square are at precisely 90 degrees to adjacent sides, with perfect optical flatness and parallelism. This device is said to be accurate to a millionth part of a circle, and can be combined with angle gage-blocks for rapid indexing. Manufactured by Webber Gage Co., 12900 Triskett Road, Cleveland 11, Ohio. 122

Automatic Spring-Actuated Collet Chuck Unit

Spring-actuated cam-released collet chuck unit developed by Erickson Tools Division, 2311 Hamilton Ave., Cleveland 14, Ohio, to speed up polishing, grinding, and similar machining operations. With this chuck equipment, the operator merely feeds and unloads the machine. The spring tension on each of the eight collet chucks shown mounted on the multiple-spindle head is released automatically by a cam. Instant expansion of the collets allows easy removal and loading of the work. Run-out and slippage are eliminated and the finish is not marred or scratched by the collets. The same design principles are also being used successfully on Erickson expanding mandrels. 123

Armstrong Portable Power Pipe-Threader

Portable power pipe-threader which can be operated by any 1/2-inch standard electric drill. Pipes of 1-, 1 1/4-, 1 1/2-, and 2-inch sizes can be threaded with one set of high-speed steel chasers. This No. 165 threader weighs only 26 pounds, and can be easily carried. It is furnished complete with one set of chasers and drive



adapter by the Armstrong Brothers Tool Co., 5200 W. Armstrong Ave., Chicago 30, Ill. 124

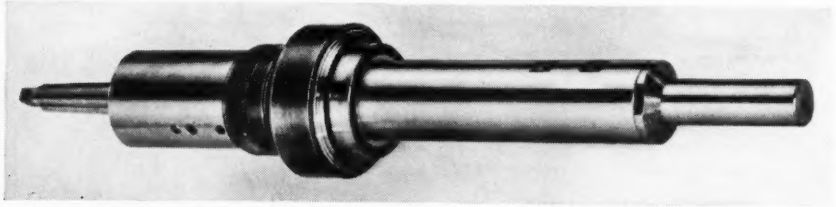
Medium-Duty Universal Chucks

(Upper views) New 5-inch medium-duty universal lathe chuck with internal and external clamping jaws and wrench, added to the line of the L-W Chuck Co., 42 S. St. Clair, Toledo, Ohio. This chuck has three separate pinions instead of the usual single pinion. It can be used on any lathe having a 1 1/2-inch eight-thread spindle. By the use of a conventional back adapter plate it can be mounted on any size and type of lathe. (Lower view) Extra sturdy independent four-jaw chuck with reversible jaws, hardened and ground steps, and cast semi-steel body with ground finish, also brought out by the company. Made in 6- and 8-inch sizes. 125

To obtain additional information on equipment described on this page, see lower part of page 230.

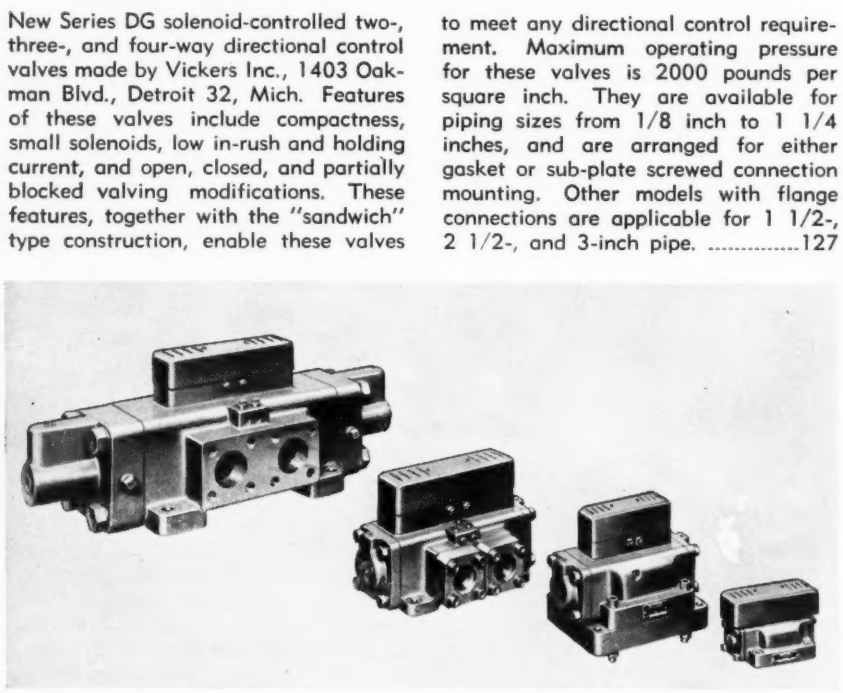
Maxwell Large-Size Automatic Recessing Tool

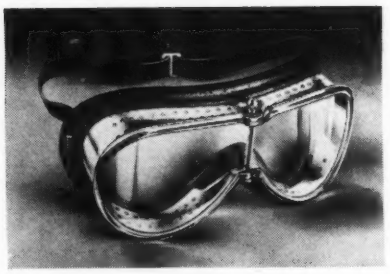
New large-size automatic recessing tool designed especially for use on radial drills, boring mills, and large boring machines, as well as on drill presses. This new tool, recently brought out by the Maxwell Co., 420 Broadway, Bedford, Ohio, employs the same standard "Max-Well" rack and gear operating mechanism as is used on the smaller tools of the same line, and can be employed in conjunction with comparatively heavy machines for recessing internal surfaces normally considered inaccessible with standard equipment. Cutter feeds can be furnished in a ratio of approximately 1 to 3 relative to the spindle speed. High-speed steel or carbide-tipped cutters can be supplied. 126



Vickers Directional Hydraulic Control Valves

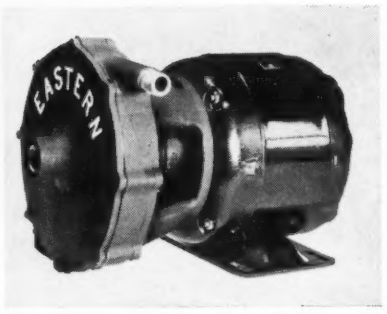
New Series DG solenoid-controlled two-, three-, and four-way directional control valves made by Vickers Inc., 1403 Oakman Blvd., Detroit 32, Mich. Features of these valves include compactness, small solenoids, low in-rush and holding current, and open, closed, and partially blocked valving modifications. These features, together with the "sandwich" type construction, enable these valves to meet any directional control requirement. Maximum operating pressure for these valves is 2000 pounds per square inch. They are available for piping sizes from 1/8 inch to 1 1/4 inches, and are arranged for either gasket or sub-plate screwed connection mounting. Other models with flange connections are applicable for 1 1/2-, 2 1/2-, and 3-inch pipe. 127





"Panoram" Goggle

"Panoram" goggle with rubber cushions molded to the exact shape of the "Panoram" eye-cup which can be very easily slipped into place. These cushions provide extra wearing comfort and are so designed that they stay fixed in their position, but can be replaced in a few seconds. Made by the American Optical Co., Southbridge, Mass. 128



Eastern Centrifugal Pump

Centrifugal pump designated Model H, recently developed by Eastern Industries, Inc., 296 Elm St., New Haven 6, Conn. Designed for applications where moderate pressure and volume capacities are required with pump operating at a speed of 1725 R.P.M. Constructed of either bronze or aluminum, with a lifetime mechanical rotary seal. Available with motors ranging from 1/6 to 1/3 H.P. 129

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description — or write directly to the manufacturer, mentioning machine as decribed in March, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME..... **POSITION OR TITLE**.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY..... **STATE**.....

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 236 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the March, 1949, Number of MACHINERY

Plastic Chuck Jaw Blanks

GISHOLT MACHINE CO., Department A-M, Madison 10, Wis. Leaflet announcing new light-weight plastic soft jaw blanks for chucks, designed for use on thin-walled work-pieces and finely finished surfaces. Complete information obtainable by writing on a company letter-head to Gisholt Machine Co. at address given above.

Electronic Speed Control Equipment

RELIANCE ELECTRIC & ENGINEERING CO., 1077 Ivanhoe Road, Cleveland 10, Ohio. Bulletin K-2101, describing an electronic device known as the Reliance VSS "short-stroke dancer roll" for speed control problems in wire drawing, rubber extrusion, plastic coating, and similar continuous process applications. 1

Tap Handbook

CHARLES H. BESLY & CO., 118-124 N. Clinton St., Chicago 6, Ill. Pocket-size catalogue and handbook containing 111 pages of data on taps. Twenty-eight different types of taps made by the company are listed, with complete specifications. Technical information includes classification of fits, tap drill sizes, cutting speeds and lubricants, etc. 2

Cold Roll-Forming

YODER CO., 5504 Walworth Ave., Cleveland 2, Ohio. Publication entitled "Cold Roll-Forming," describing this process and the equipment used, as well as the uses of its products. Auxiliary equipment for curving, coiling, notching, welding, and many other operations is also described. 3

Jig Borers

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Catalogue containing complete information on Pratt & Whitney jig borers and their application in high-speed precision boring. A complete list of additional equipment is included. 4

Drills and Reamers

ACE DRILL CORPORATION, Detroit 27, Mich. Catalogue 48, containing data on the complete line of ground-from-the-solid drills made by this company. A technical section contains information on cutting fluids, pointing drills, tap drill sizes, speeds, etc. 5

Jig-Borer Cutting Tools

MOORE SPECIAL TOOL CO., INC., Bridgeport, Conn. Booklet on jig-borer cutting tools, giving feeds, speeds, and estimated time for various precision jig-boring operations, as well as constants for converting spindle speeds for different materials. 6

Steel Forgings

STEEL IMPROVEMENT & FORGE CO., 969 E. 64th St., Cleveland, Ohio. Publication entitled "The Improvement of Metals by Forging," containing 44 pages of data on the characteristics and applications of steel forgings, including points on designing. 7

Lubrication Equipment

STEWART-WARNER CORPORATION, ALEMITE DIVISION, 1826 Diversey Parkway, Chicago 14, Ill. Catalogue covering the complete Alemite line of industrial lubrication equipment, with guide to selection of correct lubricant and equipment for specific needs. 8

"Equi-Grip" Hand Vise

GEORGE—ANDERLE MFG. CO., 2116 Salem Ave., Dayton 6, Ohio. Circular illustrating and describing a new "Equi-Grip" hand vise with toggle action and removable jaw plates designed for the fast handling of small production parts.....9

Electric Air Control Valve

HANNIFIN CORPORATION, 1101 S. Kilbourn Ave., Chicago 24, Ill. Bulletin 230, describing the company's "Directair" electric valve recently developed for the control of single- or double-acting air cylinders, air-operated presses, and similar equipment. 10

Dual-Ram Surface Broaching Machines

COLONIAL BROACH CO., Box 37, Harper Station, Detroit 13, Mich. Bulletin describing the company's improved line of dual-ram surface broaching machines; dimensional drawings, specifications, operating data, etc., are included. 11

Arc-Welding

JAMES F. LINCOLN ARC WELDING FOUNDATION, Cleveland 1, Ohio. Pamphlet containing an article entitled "Application of Arc-Welding to Locomotives," by F. H. Harrison, chief mechanical engineer of the South Australian Railways. 12

Centrifugal Casting

LEBANON STEEL FOUNDRY, Lebanon, Pa. Booklet explaining a new process of centrifugal die-casting known as the "Centri-Di"

How to Build Links at Less Cost with Arc Welding

The links and clevises shown above are typical of the many different kinds of machinery component parts that are being fabricated today at less cost with arc welding than with other methods. Welded steel parts like these are decidedly stronger and more rigid, yet require considerably less material to build. Amazingly simple in design, welded steel machinery parts can be produced efficiently in all quantities using steel plate and standard mill shapes and forms.

More detailed data on the design of links and other machinery parts for arc welding is contained in the "Procedure Handbook of Arc Welding Design and Practice." Price $1.50 postpaid in the U. S. A., elsewhere $2.00.

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress. Machine Design Studies are available to engineers and designers. Write on your letterhead to The Lincoln Electric Company, Dept. 23, Cleveland 1, Ohio.*

casting—a method developed for casting circular shapes in permanent molds to meet exacting requirements.....13

Permanent Magnets

GENERAL ELECTRIC CO., Pittsfield, Mass. Catalogue CDM-2A, containing data of use in ordering stocked G-E permanent magnets. A wide variety of cast and sintered Alnico magnets, as well as special magnetic alloys, are listed. 14

Corrosion Data

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York 5, N. Y. Pamphlet entitled "Corrosion by Concentration Cells," containing technical information on the reasons for galvanic cell corrosion and methods of overcoming it. 15

Overhead Crane and Monorail Systems

WHITING CORPORATION, Harvey, Ill. Catalogue containing complete information on Whiting "Trambeam" overhead crane and monorail systems, including specifications and illustrations showing typical applications. 16

Abrasive Wheels

ALLISON CO., Bridgeport 8, Conn. Bulletins 19 48BR and 29 48P, on ball-race grinding wheels and rubber-bonded polishing wheels, respectively. Bulletins 49 48B and 49 48R, on resinoid-bonded and rubber-bonded abrasive cut-off wheels, respectively. 17

Hydraulic Duplicators

WALKER HYDRAULIC DUPLICATOR CO., Box 72, Standish, Mich. Circular descriptive of the Walker hydraulic duplicators for tracer-controlled machining on boring mills, milling machines, lathes, planers, grinders and special machines. 18

Copper and Copper Alloys

AMERICAN BRASS CO., Waterbury 88, Conn. Publication B-34 (second edition), containing an index to standard specifications of engineering societies and government agencies for copper and copper alloys. 19

Fan-Cooled Motors

ALLIS-CHALMERS MFG. CO., S. 70th St., Milwaukee, Wis. Circular 05B7150 describing the outstanding features of Allis-Chalmers totally enclosed fan-cooled motors with tube type air-to-air heat exchangers. 20

Water-Hydraulic High-Pressure Controls

HYDROPRESS, INC., 570 Lexington Ave., New York 22, N. Y. Folder HL-43, illustrating and describing hydraulic control valves, prefilling valves, stop valves, etc., and combinations of valves for sequence operation. 21

Pickling and Washing Machines

B. F. GOODRICH CO., Akron, Ohio. Folder describing the construction, operation, and advantages of the Goodrich pickling and washing machine which prepares metal products for painting, plating, etc. 22

Magnetic-Induction Truck Drive

CLARK EQUIPMENT CO., Battle Creek, Mich. Bulletin TC-24, illustrating and describing the "Dynatork" drive, an entirely new design of magnetic-induction drive for fork trucks which eliminates clutches. 23

Rotary Gear Shapers

FELLOWS GEAR SHAPER CO., 78 River St., Springfield, Vt. Circular 10, illustrating and describing in detail the Fellows No. 10 rotary gear shaper for the mass production of external and internal spur and helical gears.....24

Steel Hardening Compound

WILSON CARBON CO., INC., 60 E. 42nd St., New York 17, N. Y. Circulars describing a new activated carbon steel catalyst known as "Hi-Speed-It" for the quick and deep carbon hardening of any type of ferrous metal. 25

Industrial Furnaces

SURFACE COMBUSTION CORPORATION, Toledo, Ohio. Bulletin SC-141, illustrating and describing the company's line of standard-rated industrial furnaces for hardening, tempering, forging, metal melting, etc. 26

Soldering Manual

KESTER SOLDER CO., 4201 Wrightwood Ave., Chicago 39, Ill. Technical manual entitled "Solder and Soldering Technique," containing a complete analysis of the properties and application of soft solder alloys and soldering fluxes. 27

Sharpening Milling Cutters

CINCINNATI MILLING MACHINE CO., Cincinnati 9, Ohio. Booklet M-1657, entitled, "Look Sharp at Your Cutters," containing practical data in tabular and chart form to aid in sharpening milling cutters correctly. 28

Lathes

SIDNEY MACHINE TOOL CO., Sidney, Ohio. Bulletin illustrating and describing the construction features of the Sidney Model 32 engine and tool-room lathes, which are made in 14-, 16-, 18-, and 20-inch sizes. 29

Safety Trip for Presses

MICRO-SWITCH, Freeport, Ill. Bulletin 51, descriptive of the "Microtrip," a new electrical safety trip device requiring two-hand operation, for punch presses, riveting machines, and similar power-operated equipment. 30

Plastics Testing Machines

TINIUS OLSEN TESTING MACHINE CO., 1052 Easton Road, Willow Grove, Pa. Bulletin 36, containing 36 pages of information on the Olsen physical testing equipment designed especially for application on plastics. 31

Hacksaw Blade of New Design

DIAMOND SAW WORKS, INC., Buffalo, N. Y. Folder outlining the advantages of the "Super-Sterling" "repeater power" hacksaw blade, which incorporates the broach principle of generating cutting action. 32

Material-Handling Equipment

EQUIPMENT MFG. INC., P. O. Box 3838, Detroit 5, Mich. Catalogue describing portable material-handling equipment of the stacking type, including stock racks of various kinds and collapsible boxes. 33

Hard-Facing of Dies

WALL COLMONOY CORPORATION, 19345 John R St., Detroit 3, Mich. Engineering Data Sheet containing information on the procedure for hard-facing forming and drawing dies with Colmonoy alloys. 34

Carbide Tool-Holders

VASCOLOY-RAMET CORPORATION, 800 Market St., Waukegan, Ill. Catalogue V-R 430, covering the complete line of "Bulldog" tool-holders developed specifically for the use of carbide and cast-alloy inserts. 35

Tenite Specifications

TENNESSEE EASTMAN CORPORATION, Kingsport, Tenn. Technical book (fifth edition) containing complete specifications of the cellulose ester plastics known as "Tenite," including physical properties and results of tests. 36

Contour Milling Machine

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Catalogue illustrating and describing a new cam-controlled milling machine developed for the contour milling of small parts...37

Bronze Bearings

JOHNSON BRONZE CO., 520 S. Mill St., New Castle, Pa. Catalogue covering the company's complete line of bronze bushings and bearings; includes data on bar bronze and babbitt. 38

Diamond Dressing Tools

DIAMONDS & TOOLS, INC., 19345 John R, Detroit 3, Mich. Pamphlet containing descriptive data, including price list, of the company's line of diamond dressing tools with Colmonoy setting.....39

Industrial Trucks and Tractors

HYSTER CO., Portland 8, Ore., is publishing a new house organ entitled "Lifts," which will contain articles on materials-handling with various types of industrial trucks. 40

Broaching Machines

AMERICAN BROACH & MACHINE CO., Ann Arbor, Mich. Catalogue 400, covering the company's complete line of vertical pull-up internal broaching machines, including specifications and applications on a variety of work. 41

Rough-Grinding Wheels

NORTON CO., Worcester 6, Mass. Booklet containing complete information on Norton wheels for rough-grinding and their application in foundries, welding, forge, and machine shops. 42

Universal Speed Reducers

EUCLID UNIVERSAL MACHINE, INC., 15012 Woodworth Road, Cleveland 10, Ohio. Circular describing the advantages of the Euclid universal speed reducers and the various types. 43

Conveying Equipment

MAY-FRAN ENGINEERING, INC., 1710 Clarkstone Road, Cleveland 12, Ohio. Circular describing the construction and application of May-Fran steel-belt (hinge type) conveying equipment. 44

Measuring Microscopes

GAERTNER SCIENTIFIC CORPORATION, 1201 Wrightwood Ave., Chicago 14, Ill. Bulletin 161-48, illustrating and describing measuring microscopes for laboratory and shop use. 45

Belt Drive Design Data

UNITED STATES RUBBER CO., Rockefeller Center, New York 20, N. Y. Manual containing 100 pages of data compiled to assist engineers in the design of both multiple and light-duty V-belt drives. 46

Special-Purpose Files

NICHOLSON FILE CO., 18 Acorn St., Providence 1, R. I. Catalogue containing information on the application of special files for aluminum, babbitt, brass, copper, and other materials. 47

Hydraulic Cylinders

GEROTOR MAY CORPORATION, Baltimore 3, Md. Catalogue Section 103, describing standard hydraulic cylinders and giving complete diagrams and information to aid in laying out circuits.....48

Chucks

E. HORTON & SON CO., Windsor Locks, Conn. Condensed catalogue C48, containing data on work-holding tools for lathes, drills, and special applications. 49

Quick-Action Vises

HARTMANN MFG. CO., 1600 Junction Ave., Racine, Wis. Bulletin 201, showing a few examples of the many uses of Hartmann quick-action vises. 50

Socket Screw Price List

BRISTOL CO., Waterbury 91, Conn. Price lists 874 and 875 covering hexagon socket screws and multiple-spline screws, respectively. 51

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publication wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (March, 1949) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

By E.S.S.

BETWEEN GRINDS

The Undaunted

While waiting for a package, an elderly messenger sat in our office reading avidly. Surrounded he was by technical literature, but impervious he also was, as he pored through "Love Comes of Age."

Of Archival Import

"Mr. Speaker, under leave to extend my remarks in the *Record,* I include the following article by Charles O. Herb from MACHINERY for January, 1949." Thus did the Honorable Frances P. Bolton, Congresswoman for Ohio, introduce "The Machine Tool Industry and National Defense" in the House of Representatives. Entered in the *Congressional Record,* daily journal of Congressional proceedings, the editorial became, in fact, history.

Don't Dissolve the Partnership

A letter-head on our desk caused some speculation: The Sink and Float Corporation.

Thawed Out of a Glacier

Not so long ago we reported ("Jammed in a Desk Drawer") the receipt of a coupon nineteen years old; the record has now been bettered by four years. A faded clipping that had once been green arrived from Manitoba, Canada, inquiring particulars on certain used machine tools listed in MACHINERY'S Green Section. Meanwhile, the process of evolution has turned this Green Section into today's Classified and Re-Sale Section.

Vocabulary Exchange

Having noted some British equivalents of American automotive terms in "Automobile Facts," we decided to put them together. However authentic, it doesn't read like the opening pages of a great English novel: We started on our trip, two of us up front and two in the dickey seat (1), with our baggage in the luggage boot (2). After stopping for petrol (3), I hit up (4) on the build up (5), using my tooter (6) as a pedestrian stepped off the pavement (7). We passed a motor car that had just sustained a burst (8) when ours suddenly came to a halt. Lifting the bonnet (9), I examined the gearbox (10) and decided the trouble was with my dynamo (11). I put the hood (12) down so my passengers could better enjoy the scenery while I tried to rev up (13). [The enumerated words are, in Americanese, rumble seat (1); trunk (2); gasoline (3); stepped on gas (4); paved road (5); horn (6); sidewalk (7); blowout (8); car hood (9); car transmission (10); generator (11); car top (12); and race the engine (13)].

Minor Investment for Major Return

Five years ago an article published in MACHINERY on negative-rake milling was in such great demand that we reprinted it and for several years sold the reprints (25 cents per copita) to our eager customers. There are still a few available, free to readers of this page. Just address a penny postcard to the Between Grinds Editor.

Meeting Up with Money—Contributor FRED B. MONEY (intriguing surname fraught with pun possibilities, ah me!) born in Iowa of early American pioneer stock and with an academic background by reason of his father being a minister and his mother a schoolteacher, worked his way through college and later in life added two more degrees to the one conferred on him by Iowa State. Shop apprentice with the U. S. Steel Corporation to chief inspector at the North Works of Illinois Steel Co. to efficiency engineer at the American Bridge Co., but heave to—here Mr. Money took a nautical turn, becoming superintendent

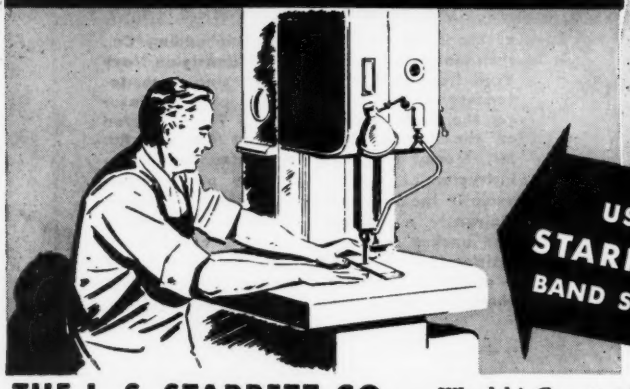
of shops for the Pensacola Shipbuilding Co., then master mechanic in the Philadelphia Navy Yard from 1932 to 1944, and since, superintendent of the forge shop and plant engineer for the Baldt Anchor, Chain & Forge Division of the Boston Metals Co. at Chester, Pa. Mr. Money has many correlated interests—instructor of metallurgy these past sixteen years in the evening technical school of Temple University, a student in the history of anchors and anchor chains, and a writer of technical articles (see page 149). Then he has a hobby—analyzes technical processes and converts them into simple rules for non-technical men.

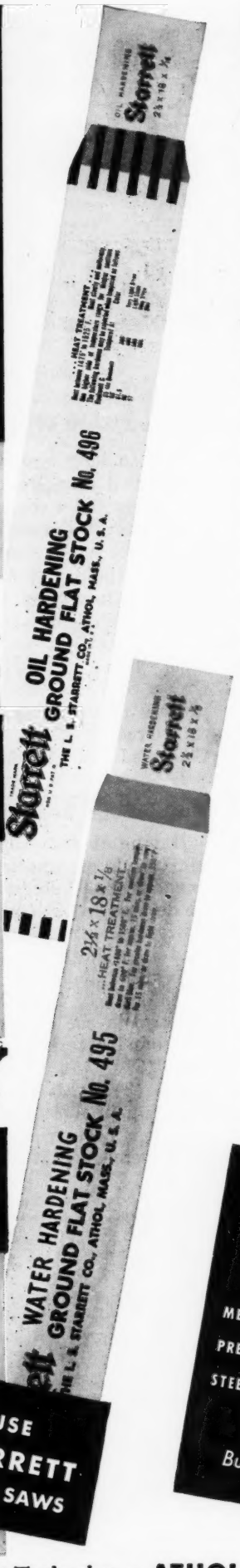
SAVE 2 OPERATIONS

Producing Small Precision Parts

Just LAY IT OUT...

and CUT IT OUT

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OIL HARDENING
GROUND FLAT STOCK No. 496
THE L. S. STARRETT CO., ATHOL, MASS., U.S.A.
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THE L. S. STARRETT CO., ATHOL, MASS., U.S.A.

USE STARRETT BAND SAWS

STARRETT
PRECISION GROUND
FLAT STOCK

Hunting up stock and grinding it to size for parts like special gages; templates; jig, fixture and machine parts; punch dies; etc., ties up men and machines—takes time that can be put to better use today. A supply of STARRETT Precision Ground Flat Stock will stop that waste. Your STARRETT Distributor carries a complete stock. Order a supply today.

STARRETT Precision Ground Flat Stock is high grade annealed tool steel cut lengthwise from the sheet and ground to within .001" in thickness, 18-inch lengths, widths from ½ to 6 inches, thicknesses from 1/64" to 1" and more. Each piece individually wrapped and marked with size, type and heating instructions.

No. 496 OIL HARDENING

A non-deforming, electric furnace tool steel, fully spherodized annealed with fine grain structure and deep hardening characteristics. Ideal for precision parts which require accuracy of size after hardening.

No. 495 WATER HARDENING

A high grade tool steel specially annealed for easy machining. Develops maximum hardness when quenched in water or brine and may be drawn to any desired temper in oil.

Write for Ground Flat Stock Folder and Chart D giving Formulas for both Oil and Water Hardening

Starrett

Standard of Precision

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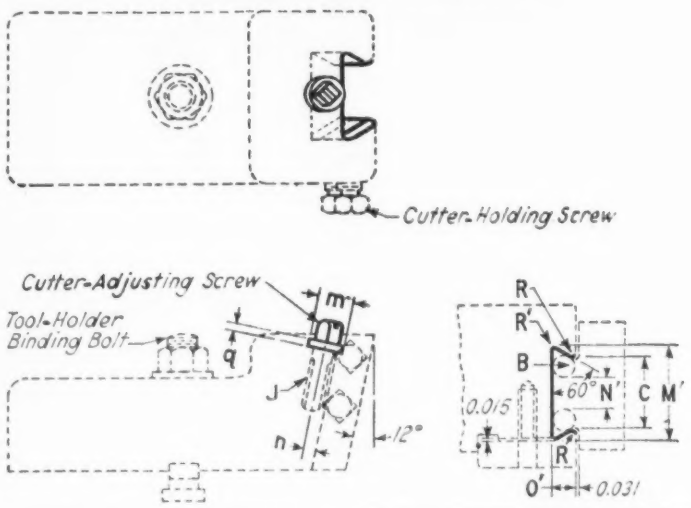
STANDARD DOVETAILED FORMING TOOL HOLDERS—1

Prepared by the American Society of Mechanical Engineers and Approved by American Standards Association

Typical Dovetailed Forming Tool Holder with Collar-Head Screw Adjustment



Width M′	Width C	Between Plugs N′*	Depth O′†	Plug Diam. B	Radius R	Radius R′	Screw Location n	Adjusting Screw: Collar Diam. m	Adjusting Screw: Collar Thickness‡ q	Adjusting Screw: Thread Size§ J
0.732	0.489	0.305	1/4	5/32	1/32	1/64	11/64	5/16	0.122	1/4–28
0.951	0.690	0.524	17/64	5/32	1/32	1/64	13/64	5/8	0.122	5/16–24
1.250	0.9085	0.567	3/8	1/4	1/16	3/32	15/64	11/16	0.152	5/16–24
1.614	1.110	0.248	33/64	1/2	1/16	3/32	17/64	11/16	0.184	3/8–24
1.882	1.378	0.516	33/64	1/2	1/16	3/32	17/64	11/16	0.184	3/8–24
2.000	1.532	**0.634**	31/64	1/2	1/16	3/32	21/64	1	0.245	7/16–20
2.238	1.734	0.872	33/64	1/2	1/16	3/32	21/64	1	0.245	7/16–20
2.883	2.235	1.175	41/64	5/8	1/16	3/32	21/64	1	0.245	7/16–20

All dimensions are given in inches. Tolerances for dimensions not otherwise specified shall be held to + 0.010.

*Tolerance for the dovetail measured between plugs *N′* is + 0.002, — 0.000.

†Tolerance for the depth of dovetail *O′* is ± 0.003.

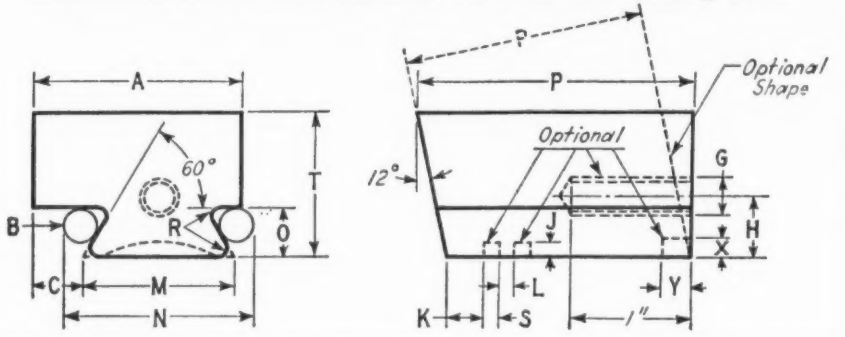
‡Tolerance for thickness of collar is + 0.000, — 0.002.

§The threads shall be made to Class 2 (NC–2, ASA B1.1—1935).

STANDARD DOVETAILED FORMING TOOL BLANKS—3

Prepared by the American Society of Mechanical Engineers and Approved by American Standards Association

Dimensions for Finished Blanks for Dovetailed Forming Tools



Machine Group No.*	Basic Blank Size†	Across Plugs N‡	Plug Diam. B	Adjusting Holes: G	Adjusting Holes: H§	Slots: Number	Slots: J§	Slots: K	Slots: L	Slots: S¶	Hook-Bolt Adj.-Nut Notch: Width Y	Hook-Bolt Adj.-Nut Notch: Depth X
1	1	0.834	5/32	5/16–18	3/8	2	1/8	5/16	1/8	1/8	3/16	3/16
	1¼	1.035	5/32	5/16–18	1/2	2	1/8	5/16	1/8	1/8	3/16	3/16
2	1¼	1.035	5/32	5/16–18	1/2	3	1/8	11/32	1/8	1/8	3/16	3/16
	1½	1.035	5/32	5/16–18	1/2	..	..	..	..	..	3/16	3/16
	1¾	1.464	1/4	5/16–18	1/2	3	1/8	11/32	1/8	1/8	1/4	1/4
	2¾	2.771	1/2	7/16–14	5/8	3	1/8	5/16	3/32	5/32	5/16	5/16
3	1¾	1.464	1/4	5/16–18	1/2	3	1/8	7/16	3/32	5/32	1/4	1/4
	2¼	1.464	1/4	5/16–18	1/2	..	..	..	..	..	1/4	1/4
	2¾	1.464	1/4	5/16–18	1/2	..	..	..	..	..	1/4	1/4
4	2¾	2.349	1/2	5/16–18	1/2	..	..	..	..	..	1/4	1/4
	2¾	2.617	1/2	7/16–14	5/8	..	..	..	..	..	1/4	1/4
	3	2.617	1/2	7/16–14	5/8	..	..	..	..	..	1/4	1/4
5	2¾	2.771	1/2	7/16–14	5/8	..	..	..	..	..	5/16	5/16
	2¾	2.771	1/2	7/16–14	5/8	..	..	..	..	..	5/16	5/16
	3	2.771	1/2	7/16–14	5/8	..	..	..	..	..	5/16	5/16
	3¼	2.771	1/2	7/16–14	5/8	..	..	..	..	..	5/16	5/16
6	3¼	2.973	1/2	7/16–14	5/8	..	..	..	..	..	5/16	5/16
	3½	3.815	5/8	7/16–14	5/8	..	..	..	..	..	5/16	5/16
	4	3.815	5/8	7/16–14	5/8	..	..	..	..	..	5/16	5/16
	4½	3.815	5/8	7/16–14	5/8	..	..	..	..	..	5/16	5/16

All dimensions are given in inches.

*Machine classifications by group number given in Data Sheet 627, February, 1949.

†Blanks made of high-speed steel shall be stamped H.S.

‡The tolerance for width of dovetail *N* measured across plugs *B* is + 0.003 inch or — 0.003 inch.

§Methods of adjustment are optional.

¶Tolerance for width of adjusting slot *S* is + 0.003 inch, — 0.000 inch.

BROACH MAINTENANCE OPERATIONS

A RESHARPENING

Restoring cutting edges that have been dulled from normal use.

B RECONDITIONING

1. Along with normal resharpening, it is often necessary to "recondition" broaches for correct cutting action. That is, "gum out" between the teeth when sharpening has reduced chip clearance beyond working limits.

2. After several sharpenings, and even gumming out, it is sometimes economical to "re-sink" the entire form on form tools.

C SALVAGING

Broken broaches can often be returned to full production duty after salvaging operations. Broken shanks can be repaired by welding, broken teeth can be re-stepped in some cases, etc.

Another important phase of salvaging is the conversion of good broaches to do jobs other than that for which they were originally designed. If engineering or production changes prohibit the use of present broaching tools, perhaps they can be converted to do other operations.

Ever since we designed and made the first set of broaches at Detroit Broach, we have welcomed broaches that were returned to us for maintenance, whether resharpening, reconditioning or salvaging was required. It is just as important to us to keep broaches "on the job" as it is to design, make and deliver new ones. There are advantages to you, too!

To perform any one of the three broach maintenance operations—they're defined at the left—requires proper equipment, inspection facilities and knowledge of broach design. Every broach returned to us should naturally be accompanied by instructions from the customer. In the light of these instructions it will be inspected by one of our engineers. He determines whether or not it is advisable to repair the tool—sometimes it is most economical not to—and if it is advisable, designates what operations are required. These operations are then performed on equipment selected for that purpose—by men skilled in broach maintenance. Finally, the broach is inspected on the finest and most complete broach inspection equipment available . . . following the same detailed inspection procedure used on new broaches.

Many of our customers have always taken advantage of this service because it has proven to save them money. We suggest that you do, too . . . to guarantee the ultimate in broaching production at lowest over-all tool cost.

DETROIT *Broach* COMPANY

20201 SHERWOOD AVE. DETROIT 12, MICH.

News of the Industry

Canada

INTERNATIONAL NICKEL CO. OF CANADA LTD., announces the following changes in personnel: DR. JOHN F. THOMPSON, executive vice-president, has become president, succeeding ROBERT C. STANLEY, who has relinquished this post but will continue to serve as chairman of the board; PAUL D. MERICA will take Mr. Thompson's place as executive vice-president; and HENRY S. WINGATE, secretary of the company since 1939, has become a vice-president.

California and Oregon

A. L. HAWLEY, formerly assistant works manager of the Plomb Tool Co., has been appointed works manager of the main factory in Los Angeles, Calif. Mr. Hawley joined the company in 1936, and has served successively as assistant factory superintendent, superintendent of time study, chief engineer, and assistant works manager.

CHAIN BELT CO., Milwaukee, Wis., announces that its Los Angeles district office and warehouse has been moved to new and larger quarters at 3838 Santa Fé Ave., Los Angeles 11, Calif.

FLOYD V. SNODGRASS has been named general manager of the Nordstrom Valve Division, Rockwell Mfg. Co., Oakland, Calif.

FRANCIS W. VIGNEAULT, JR., has been named district representative in the northeastern territory for tractor equipment made by the Hyster Co., Portland, Ore.

Delaware and Maryland

M. W. REED has been appointed vice-president, engineering, of the United States Steel Corporation of Delaware, succeeding B. H. LAWRENCE, who is retiring after more than forty-four years of service with the corporation. Mr. Reed was previously chief engineer.

C. J. BURNSIDE, who has been associated with radio and electronic activities of the Westinghouse Electric Corporation, Pittsburgh, Pa., for twenty-four years, has resigned and organized an independent industrial consultant service, with headquarters in Baltimore, Md.

WARD LEONARD ELECTRIC CO., Mount Vernon, N. Y., has opened a branch office and warehouse at 420 S. San Pedro St., Los Angeles 13, Calif.

Illinois and Indiana

GILBERT J. LANGENDERFER has been made district industrial engineer in the Indiana territory for the Surface Combustion Corporation, Toledo 1, Ohio, replacing HARRY O. BENNETT, who has resigned to enter another field. For the last eight years, Mr. Langenderfer has served as industrial engineer in the Chicago office of the company. Mr. Langenderfer's headquarters will be at the Chicago office of the company until other arrangements have been made.

UNITED PRECISION PRODUCTS CO., INC., Shabbona, Ill., manufacturer of reversible plug gages and other precision gages, announces the appointment of the following officers: President, HUGO J. HACKLA; vice-president, PAUL KIERSCH; and secretary-treasurer, ROBERT J. KELTER. Mr. Kelter was also made general manager, and A. WALT was appointed chief engineer. W. K. GALLAGHER has been promoted from sales representative to sales manager.

BROACH ENGINEERING CO., 525 N. Noble St., Chicago 22, Ill., has been organized to engage in the manufacture of broaches and broaching fixtures, and to provide a complete broach engineering service for manufacturers that have no broaching facilities.

EDWARD F. HALLISSEY has been transferred to the sales department of the Chicago office of Billings & Spencer Co. at 100 S. Jefferson St., Chicago 6, Ill. ROBERT J. HUELSMAN has also been added to the sales staff of the Chicago office.

HARRY D. SWEENEY has been appointed sales manager of welding products for the American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill. He formerly held the position of sales engineer.

WILLIAM E. GAHL has been appointed chief engineer of Templeton, Kenly & Co., Chicago, Ill., manufacturers of Simplex jacks. He succeeds F. J. JAKOUBEK, who has resigned to go into business for himself.

NATIONAL FOUNDERS ASSOCIATION, 120 S. LaSalle St., Chicago 3, Ill., announces that the name of the Association has been changed to NATIONAL FOUNDRY ASSOCIATION.

STANDARD LOCKNUT & LOCKWASHER, INC., announces the removal of the company from 311 N. Capitol Ave., Indianapolis, Ind., to larger quarters at 118 West St.

John R. Bartizal, New Executive Vice-president, Clearing Machine Corpn.

JOHN R. BARTIZAL has become executive vice-president of the Clearing Machine Corporation, Chicago, Ill., manufacturer of metal-forming presses. Mr. Bartizal has been associated with the company since 1945. He was previously treasurer.

Michigan

STEWART KERR, a Detroit attorney, has been appointed executive secretary of the National Association of Engineering Companies, 1601 Dime

Stewart Kerr, Executive Secretary of the National Association of Engineering Companies

Bldg., Detroit 26, Mich., a non-profit organization of engineering firms engaged in technical activities having to do with industry and manufacturing. The scope of the work of the member companies includes product engineering and design, tool engineering and design, production engineering, time study, engineering accounting, cost control, quality control, and related technical fields.

HENRY J. KINGSBURY, chief engineer of Hammond Machinery Builders, Inc., Kalamazoo, Mich., recently completed fifty years of service with the company. In the future, he will

Henry J. Kingsbury, Chief Engineer of Hammond Machinery Builders, Inc., Who has Recently Completed Fifty Years of Service

devote himself to engineering research and development for the concern, on a partial retirement basis.

E. W. BLISS Co., Detroit, Mich., has established a new replacement parts program for users of Bliss presses. Parts distribution has been centralized in two plants—Toledo, Ohio, and Hastings, Mich., and 70 per cent of the replacement parts will be carried in finished inventory or rough stock, so that they can be supplied to users rapidly. A. A. FRANK has been named parts manager, in charge of the new program.

UNIVERSAL PRODUCTS CO., INC., Dearborn, Mich., manufacturer of universal joints and propeller shafts, announces the appointment of LEO F. FOWLER as factory superintendent; GEORGE F. BROWN as master mechanic; and MELVIN S. STERN as planning superintendent.

J. H. W. CONKLIN, sales manager of the Industrial Truck Division of the Clark Equipment Co., Battle Creek, Mich., was elected president of the Materials Handling Institute at the annual election of officers held in Philadelphia on the last day of the recent National Materials Handling Exposition. He succeeds S. W. GIBB, sales manager of the Yale & Towne Mfg. Co.

FEDERAL-MOGUL CORPORATION, Detroit, Mich., manufacturer of automotive engine bearings, announces the appointment of the following new vice-presidents: M. A. HUNTER, in charge of manufacturing; ERNEST R. DARBY, in charge of research; ROGERS I. MARQUIS, in charge of industrial relations; and NEIL A. MOORE, in charge of the service division.

FRANK A. KOVARIK, general sales manager of the Gits Brothers Mfg. Co., Chicago, Ill., manufacturer of lubricating devices and shaft steels, will be in charge of the new branch office of the company at Ludington, Mich.

MYRON ZUCKER ENGINEERING CO., Detroit, Mich., has been named representative in southeast Michigan and Toledo, Ohio, for the PRECISION WELDER & MACHINE CO., Cincinnati, Ohio, manufacturer of resistance welding equipment.

New England

L. S. STARRETT CO., Athol, Mass., announces the following changes in personnel: CARLTON S. PHILLIPS, formerly New York branch manager, has been appointed eastern sales manager; WALTER W. HASKINS, Chicago branch manager, has been made western sales manager; CARL O. NEWTON has been named New York branch manager to succeed Mr. Phillips; and ROBERT J. NORWALK will take Mr. Haskins' place as Chicago branch manager.

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass., has opened a new branch office at 1903 S. Harwood St., Dallas, Tex., with JAMES W. CATHEY as manager. Announcement has also been made of the appointment of ALVIN A. BERGMANN as manager of the New York office of the company at 130 Lafayette St.

A. ORAM FULTON, president of Wheelock, Lovejoy & Co., Inc., Cambridge, Mass., has been elected chairman of the board of directors and executive officer. FREDERICK H. LOVEJOY, who has been executive vice-president for many years, will succeed Mr. Fulton as president.

RALPH M. JOHNSON has been appointed vice-president in charge of sales by the Norton Co., Worcester, Mass. He was formerly vice-president and general sales manager of the company's abrasive division.

Ralph M. Johnson, Newly Appointed Vice-president in Charge of Sales, Norton Co.

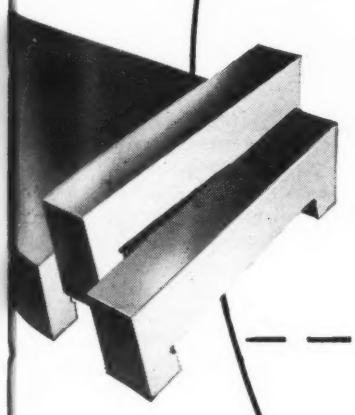
Mr. Johnson has been connected with the company since 1915, serving successively as research chemist, assistant chief sales engineer, salesman, Philadelphia district manager, chief sales engineer, and western sales manager.

WILLIAM R. MOORE was elected a director of the Norton Co., Worcester, Mass., at the last annual meeting of the board. Mr. Moore is a vice-president of the company. He has been with the organization since 1914.

ERWIN J. SCHMIEL and RALPH O. WIRTEMBURG have been appointed secretary-treasurer and sales manager, respectively, of the Norma-Hoffmann Bearings Corporation, Stamford, Conn. Mr. Schmiel succeeds EDWARD C. LENNON, who is re-

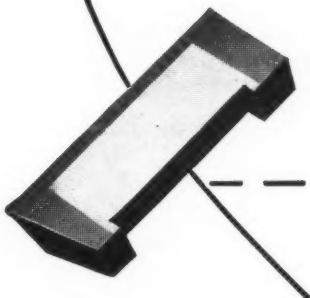
Ralph O. Wirtemburg, New Sales Manager of Norma-Hoffmann Bearings Corpn.

How Hard *are* GISHOLT'S *Hardened Ways?*



to show you . . .

We took a section from the bedways..



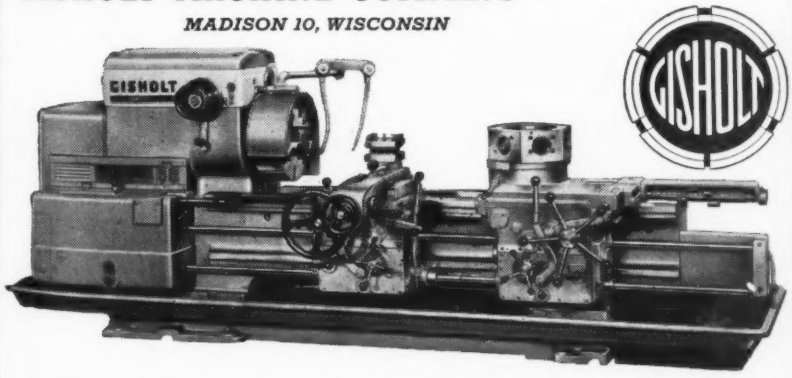
made it into a tool bit . . .

and cut metal with it!

Here it is, turning a shaft of 1045 cold rolled steel. This illustrates how precision is "hardened" into Gisholt Turret Lathes with all working surfaces hardened to 64-66 Rockwell C on ways, gibs and clamps. This extreme hardness makes Gisholt ways practically wearproof—insures lifelong accuracy—the kind of accuracy you want specified in your next turret lathe.

GISHOLT MACHINE COMPANY

MADISON 10, WISCONSIN



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS
BALANCERS • SPECIAL MACHINES

tiring after thirty-five years of service with the company. Mr. Wirtemburg, who was previously eastern regional sales manager of the New Departure Division of General Motors Corporation, takes the place of FREDERICK W. MESINGER.

R. L. DEBRAUWERE was elected assistant vice-president of the Scovill Mfg. Co., Waterbury, Conn., at a recent meeting of the board of directors. He will continue to fill his duties as assistant secretary of the company and as secretary and director of A. Schrader's Son, Inc., a division of the company.

CROWN CHEMICAL CORPORATION, Guilford, Conn., announces the purchase of the BELLIS HEAT TREATING Co., Branford, Conn., which will continue to be operated as a separate unit.

New Jersey

KENMORE METALS CORPORATION announces that it has increased its plant capacity approximately four times by the acquisition of a lease on part of the property formerly occupied by the American Brake Shoe Foundry at 380 Ninth St., Jersey City, N. J. The present production facilities of the company at Warren, Pa., will be moved to Jersey City.

MELVILLE MORRIS has been made executive vice-president and a member of the board of directors of the Optimus Equipment Co., Matawan, N. J., manufacturer of vapor degreasers and metal-parts cleaning equipment.

HARRIE T. SHEA has been elected president of the Star Electric Motor Co., Bloomfield, N. J., succeeding ELVIN E. HALLANDER, who is now chairman of the board of directors.

New York

J. ARTHUR DEAKIN & SON, 182 Sigourney St., Brooklyn 31, N. Y., has been appointed exclusive representative in the New England and Middle Atlantic states for the line of die-sinking machines, engraving machines, and allied equipment made by GEORGE H. ALEXANDER MACHINERY, LTD. of Birmingham, England.

MAJOR GENERAL (RET.) WALTER A. DELAMATER has been elected a vice-president of the Heli-Coil Corporation, Long Island City, N. Y., manufacturer of Heli-Coil screw-thread inserts.

KEMPTON DUNN was elected vice-president and CYRUS E. BRUSH secretary of the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y., at a recent meeting of the board of directors. Mr. Dunn has been with the company since graduating from college in 1932, and Mr. Brush first joined the organization in 1946, upon his return from service with the U. S. Navy.

Kempton Dunn, Newly Elected Vice-president of the American Brake Shoe Co.

CARL E. HAUGH has been appointed district sales manager of the eastern and mid-western division of Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y., builder of heavy hydraulic machinery and rolling mills. He has been a sales engineer with the company for the last three years.

HARRY H. ROSE has been named general manager of the Simmons Fastener Corporation, Albany, N. Y. During the last two years he has held the position of general sales manager of the company.

Harry H. Rose, General Manager of the Simmons Fastener Corpn.

Ohio

G. A. GRAY Co., Cincinnati, Ohio, builder of planers, planer type milling machines, and horizontal boring machines, has appointed the W. E. SHIPLEY MACHINERY Co., Philadelphia, Pa., distributor for the company in the Philadelphia and Baltimore territories. THE VANDYCK CHURCHILL Co., New York City, has been appointed distributor in eastern New York State, southern Connecticut, northern New Jersey, and the northeastern counties of Pennsylvania; and the E. A. KINSEY Co., Cincinnati, has been made distributor in southern Ohio, Kentucky, and western West Virginia.

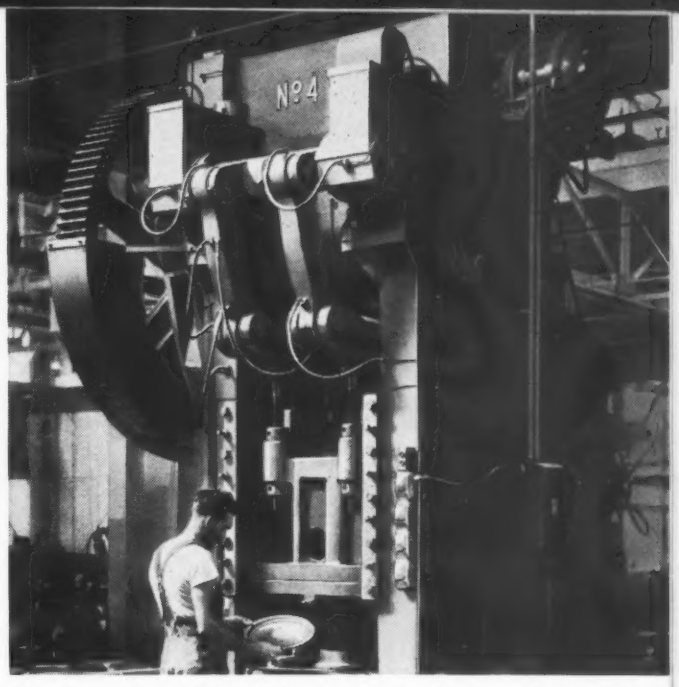
C. R. TERRY, for eleven years sales engineer with the Hydraulic Press Mfg. Co., and manager of that company's Cleveland and Pittsburgh offices for the last six years, has resigned to organize the TERRY MACHINERY Co., Hanna Bldg., Cleveland, Ohio, a sales agency for metal-working machinery. Mr. Terry is well known in the Cleveland area. Prior to his connection with the Hydraulic Press Mfg. Co., he was buyer of machinery for the B. F. Goodrich Co., of Akron, Ohio. He and his associates will represent a limited number of machine tool and metal-working equipment manufacturers throughout northeastern Ohio.

T. F. ROSE, Cincinnati branch manager of the Timken Roller Bearing Co.'s Service Sales Division, has been made manager of Timken Roller Bearing Service & Sales Ltd., Toronto, Ont., Canadian subsidiary of the Ohio company. Mr. Rose succeeds the late C. E. Webster. H. C. TELFORD, assistant manager of the Timken branch in Atlanta, Ga., has been made Cincinnati manager. SEWARD T. SALVAGE, assistant district manager of industrial bearing sales at the Cleveland office, has been made sales promotion manager, with headquarters in Canton.

EDWARD J. HRDLICKA has been elected vice-president of the Hydraulic Equipment Co., Cleveland, Ohio. He has been connected with the company for over twelve years, having previously served as chief engineer. HAROLD J. ZIMMERMAN, previously vice-president, has resigned to enter the field of industrial engineering as an independent operator.

STERLING GRINDING WHEEL DIVISION, Tiffin, Ohio, announces the addition of the following engineers to its technical staff: ROBERT G. FRIES, GEORGE BRANNICK, JR., and JOHN B. RIDDLE. Mr. Fries and Mr. Brannick will work in the laboratory on the company's new research and development program, while Mr. Riddle will serve as plant engineer.

Reservoirs for oil stoves are drawn in a Bliss No. 29 open back inclinable press equipped with Bliss die cushion. Material is 20 gauge steel .035. Main top of stove is drawn in a Bliss Double Crank Press—largest in the Florence Lewisburg plant.



One of several new Bliss toggle presses at the Florence plant forming a heater tank top. This No. 4 press is equipped with a die cushion in the bed which is used alternately for an additional forming operation or as a knockout, depending on the particular job.

PLANT GOES 100% · BLISS

"Bliss Equipment gives us up to 50% more production"

—FLORENCE OPERATIONS HEAD

Here's how G. B. Colburn, vice president in charge of Florence Stove's Lewisburg operations, sums it up. "Experience at our Gardner plant, which was 60% Bliss-equipped, proved that Bliss presses gave us higher productivity per press with less 'down-time' for maintenance and repair. Our press runs are short, die-changeover is frequent with about 1100 dies in steady use, and the presses are worked hard. Bliss equipment gives us up to 50% more production. Many of our older Bliss presses are still being used for the operations for which they were originally bought—thanks to the assistance of Bliss engineers in selecting the right press for the job."

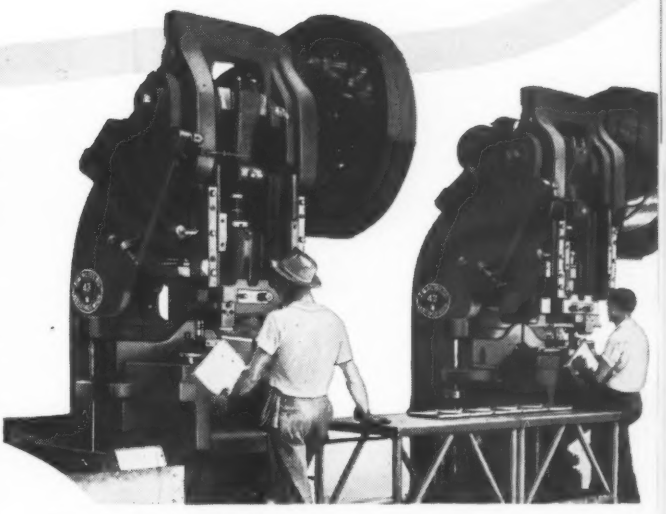
Add Florence Stove to the universal list of press users whose stamping lines are predominantly Bliss...who know that BLISS on a press is more than a name—it's a guarantee. You'll get the same dividends by putting your pressed metal problem up to Bliss.

See our catalog in SWEETS—or send for Bulletin 35B

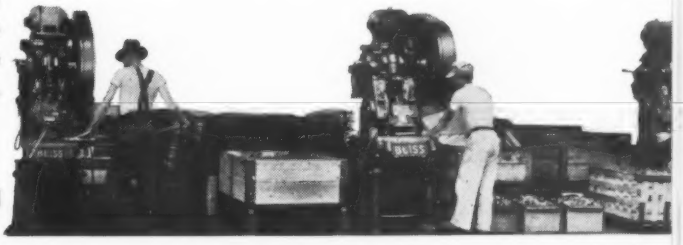
E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

WORKS AT: Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Englewood, N. J.; Derby, England; St. Ouen sur Seine, France.



Bliss Adjustable Bed Presses trim front and rear corners on lift tc covers—also perform many forming operations on other stove part Screw adjustable table gives wide range of shutheight.



Three of several dozen Bliss inclinable presses shown blanking manifold clip and leg plate for oil stove.

Louis C. Edgar, Jr., Newly Elected President of the E. W. Bliss Co.

LOUIS C. EDGAR, JR., has been elected president of the E. W. Bliss Co., builder of stamping presses, can machinery, and rolling mills. Prior to his present connection, Mr. Edgar was president of the H & B American Machine Co. He will make his headquarters at the Toledo, Ohio, works of the company.

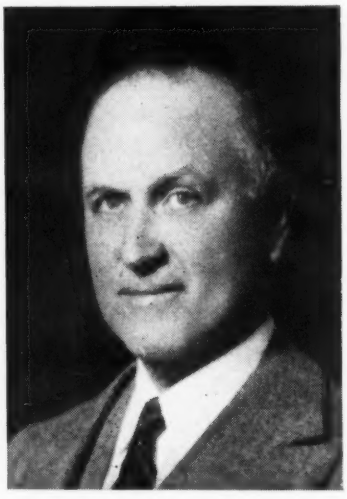
B. JOHN HEISER has been elected president of the Central Ohio Steel Products Co., Galion, Ohio, succeeding Gilbert L. Stiefel, who died last September.

JOHN C. WILSON has been elected a director of the Thompson Grinder Co., Springfield, Ohio, and has also been appointed vice-president in charge of sales. For the last ten years, Mr. Wilson has been, successively, designer, chief draftsman, chief engineer, and sales manager of the company.

John C. Wilson, Vice-president in Charge of Sales of the Thompson Grinder Co.

JAMES P. MALMSTROM has joined the Standard-Thomson Corporation, 216 S. Main St., Dayton 2, Ohio, automotive and aviation parts manufacturer, and will become head of a newly organized electronics and aircraft equipment division of the company. The new division will be located at 930 S. Ludlow St., Dayton.

OLIVER S. ACKLEY, secretary of the Niles Tool Works Co., Hamilton, Ohio, is retiring on March 1 upon the completion of forty years of association with the machine tool industry. Mr. Ackley was first connected with the Niles-Bement-Pond Co. in New York, and later went with the Niles Tool Works Co. in Hamilton, of which he has been secretary for twenty-two years. Mr. Ackley has not yet announced his plans for the future.



Oliver S. Ackley, Who is Retiring as Secretary of the Niles Tool Works Co.

EUCLID MACHINE & TOOL CO., 15002 Woodworth Road, Cleveland 10, Ohio, manufacturer of speed reducers, announces that the concern has been dissolved as a partnership and a new corporation has been formed to be known as the EUCLID UNIVERSAL MACHINE, INC. The location of the company will remain the same. Officers of the new company are president, FRED SNELLER; and executive secretary and treasurer, CLIFFORD F. SNELLER. Clifford Sneller will also continue to serve as chief engineer.

JOHN M. DOLAN has been appointed vice-president in charge of sales for the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. He formerly held a similar position with the LeRoi Co. of Milwaukee, manufacturer of internal combustion engines and construction and mining machinery.

John M. Dolan, Vice-president in Charge of Sales of the Hydraulic Press Mfg. Co.

WILLIAM I. ONG has been made assistant to the president of the American Steel & Wire Co., Cleveland, Ohio, a United States Steel subsidiary. He was formerly director of public relations, and will be succeeded in that post by LEWIS E. ZENDER, for eleven years a member of the public relations staff.

SNOW MFG. CO., Bellwood, Ill. (a suburb of Chicago), manufacturer of universal drilling, tapping, and threading machines, announces the opening of a direct factory branch office at 1720 Euclid Ave., Cleveland, Ohio. M. O. KAMPRATH has been appointed manager of the new branch.

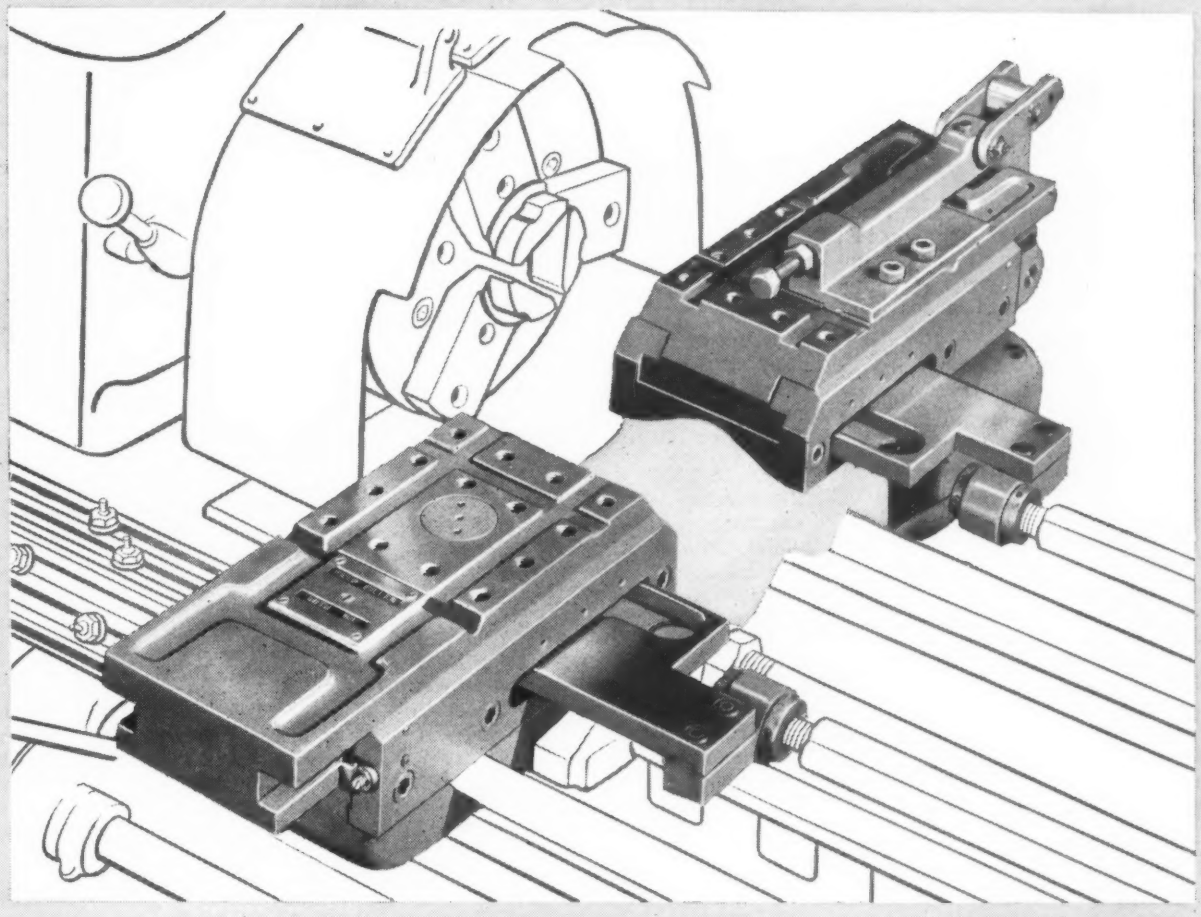
CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, has been purchased by the MCNEIL MACHINE & ENGINEERING CO., of Akron, Ohio. The business will continue to be operated as heretofore, with no changes in management, organization, or policies.

Pennsylvania

STUART H. SMITH has been made Cincinnati district manager of SKF Industries, Inc., Philadelphia, Pa. He was previously assistant district manager of the Detroit office. The following new field representatives have also been appointed: C. N. BENSON and D. B. EDEN, Boston, Mass.; A. R. EHRNSCHWENDER, Cincinnati, Ohio; J. T. PARADISE, Atlanta, Ga.; and G. L. HANSEN, Portland, Ore.

GISHOLT FASTERMATICS

(Automatic Turret Lathes)



Separate front and rear cross-slides permit independent or simultaneous operation . . . providing utmost flexibility in tooling setups . . . *GREATER PRODUCTION

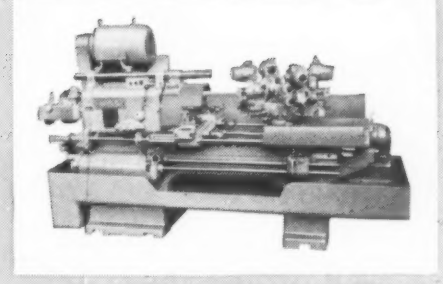
GISHOLT MACHINE COMPANY

Madison 3, Wis.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round or partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES

SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



*** Each of the Fastermatic's independent cross-slides can be used as many times as necessary within the turret cycle. Thus, you can do more different jobs.**

C. A. SCHARSCHU, director of research of the Allegheny Ludlum Steel Corporation, Pittsburgh 22, Pa., has been appointed assistant technical director. DR. L. C. HICKS, associate director of research, will fill Mr. Scharschu's former position.

O. B. WILSON, eastern regional sales manager for the Brown Instruments Division of the Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has been named manager of sales for the east, southeast, and central regions.

NELSON C. WALKER has been made district manager of the Berwick, Pa., plant of the American Car and Foundry Co., succeeding JUSTUS W. LEHR, who has been granted a leave of absence.

W. J. HARING has been appointed technical director of the Quaker Chemical Products Corporation, Conshohocken, Pa.

Wisconsin

FRANK H. STOHR has been named general manager of the Norwood Works of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Before taking over his new duties, Mr. Stohr was executive vice-president and a director of the Elliott Co., Jeannette, Pa. He succeeds R. W. DAVIS, who has been general manager of the plant since 1944. Mr. Davis will continue in an advisory capacity.

CHAIN BELT CO., Milwaukee, Wis., has opened two new district sales offices, one at 8001 Clayton Road, St. Louis, Mo., and the other at 340 W. Church St., Jasksonville, Fla. The St. Louis office will be under the direction of CLARENCE R. STUDER, and the Jacksonville office under the direction of DAVID B. HILL.

* * *

Resistance Welding Maintenance Training School

A long-range program of training designed to increase the use of resistance welding and to assure more productive use of spot, projection, flash, seam, and gun welders has been announced by the Progressive Welder Co., 3050 E. Outer Drive, Detroit 34, Mich. Two courses will be offered at the company's plant; one will provide instruction on the proper maintenance of resistance welding equipment now at work, and the other will cover design for resistance welding.

These training courses are open to any user of resistance welding equipment without charge. A booklet containing complete details is obtainable from the company at the address given above.

Coming Events

MARCH 3-5—Fifth annual conference of the AMERICAN SOCIETY OF TRAINING DIRECTORS at the Hotel Carter, Cleveland, Ohio. Chairman of the Publicity Committee, L. W. Morgan, Care of the Yoder Co., 5500 Walworth, Cleveland, Ohio.

MARCH 8-10—Passenger Car, Body, and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MARCH 10-12—Seventeenth annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Hotel William Penn in Pittsburgh, Pa. Executive secretary, Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

MARCH 14-17—SEVENTH PRODUCTION SHOW sponsored by CHICAGO TECHNICAL SOCIETIES COUNCIL at the Stevens Hotel, Chicago, Ill. For further information, address Edward C. Bowman, general manager, 8 S. Michigan Ave., Chicago 3, Ill.

MARCH 28-30—Transportation Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Statler Hotel in Cleveland, Ohio. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 7-8—Tenth meeting of the OHIO WELDING CONFERENCE at Ohio State University, Columbus, Ohio. Further details can be obtained from the Department of Welding Engineering of the university.

APRIL 8-22—GERMAN INDUSTRIAL EXHIBIT to be held at the Museum of Science and Industry, 30 Rockefeller Plaza, New York City. Exhibit sponsored and arranged by the Joint Export and Import Agency in Frankfort, Germany.

APRIL 11-12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS' CONFERENCE ON THE INDUSTRIAL APPLICATION OF ELECTRON TUBES in the Statler Hotel, Buffalo, N. Y. Headquarters of the Society, 33 W. 39th St., New York 18, N. Y.

APRIL 11-13—Fourth annual convention and Lubrication Show of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Hotel Statler (formerly Pennsylvania), New York City. Secretary, W. F. Leonard, 343 S. Dearborn St., Chicago 4, Ill.

APRIL 11-13—Aeronautic and Air Transport Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker in New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 11-16—SIXTH WESTERN METAL CONGRESS AND EXPOSITION at the Shrine Auditorium, Los Angeles, Calif. For further information, address National Secretary of American Society for Metals, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

APRIL 19-20—Annual meeting and PRODUCT EXHIBIT of the MAGNESIUM ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill. Publicity chairman, A. J. Peterson, care of Apex Smelting Co., 2537 W. Taylor St., Chicago 12, Ill.

APRIL 25-28—FOURTH SOUTHERN MACHINERY AND METALS EXPOSITION in the Atlanta Municipal Auditorium, Atlanta, Ga. Michael F. Wiedl, managing director, 267 E. Paces Ferry Road, N.E. Atlanta, Ga.

MAY 10-13—Eighteenth annual NATIONAL PACKAGING EXPOSITION in the Public Auditorium, Atlantic City, N. J. Sponsored by the American Management Association, 330 W. 42nd St., New York 18, N. Y.

MAY 19-21—Spring meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel Statler, Detroit, Mich. For further information, address the Society, P.O. Box 168, Cambridge 39, Mass.

JUNE 27-30—Thirty-Sixth Annual Convention of the AMERICAN ELECTROPLATERS SOCIETY in Milwaukee, Wis., with headquarters at the Schroeder Hotel. For further information, address the Society at 473 York Road, Jenkintown, Pa.

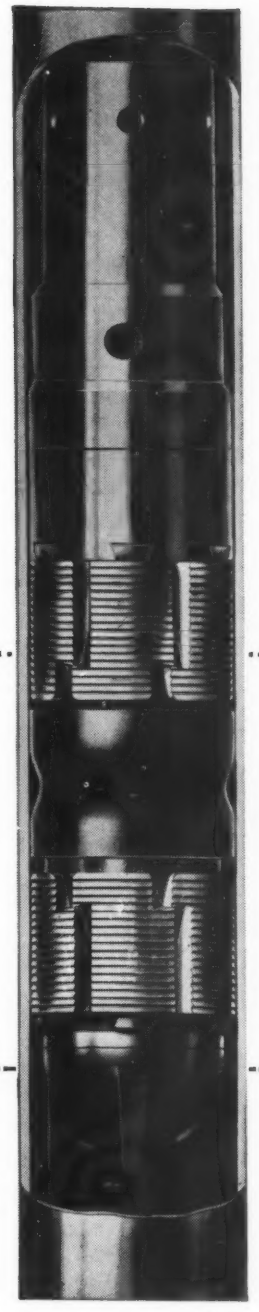
JUNE 27-JULY 1—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters of the Society, 1916 Race St., Philadelphia 3, Pa.

OCTOBER 17-21—METAL CONGRESS and EXPOSITION to be held in connection with the thirty-first annual meeting of the AMERICAN SOCIETY FOR METALS at the Public Auditorium in Cleveland, Ohio. National secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

* * *

Die Cushion Display Board

The Dayton Rogers Mfg. Co., Minneapolis, Minn., has made available to trade schools and engineering colleges a die cushion display board on which is mounted a standard installation of a pneumatic die cushion, suitable for instruction purposes. Descriptive material is included, which represents standard practice and applies to all types of pneumatic die cushion installations and designs. Engineering schools or colleges can obtain this equipment by applying to the company.



Drillable Bridging Plug made by the Lane-Wells Company, Los Angeles, California, whose successful setting depends on the shear strength of two small pins of Revere Herculoy. These plugs vary from 38″ to 58″ in length.

These are the two small pins, made of Revere Herculoy to standard shear strengths, thus assuring proper setting of the Tripset plug. Pins are shown actual size.

Dependability protected through standardized-strength Herculoy

● Here is a case in which the successful operation of a large and somewhat complicated device depends upon one of its smallest and least expensive parts. The parts are two pins of Revere Herculoy. The device is a plug employed to seal off an oil well at any desired depth, to prevent taking oil or water from lower strata.

Proper setting of this plug within the well depends on those two small pins. They must shear at exactly the right load, imposed by a special setting tool. If the pins should shear too easily, the plug might not be securely set in the well and might fall to the bottom; if the pins were too tough, the plug might not set at all. From the material standpoint, successful operation of a device costing as much as $310.00 depends on the uniform shear strength of a few cents' worth of rod.

It was to assure that uniformity that the Revere Technical Advisory Service was called into action. Studies were made of the needs, tolerances specified, and means devised to assure meeting them. The specifications when finally drawn up were rather unusual, and their fulfillment is another demonstration of Revere's ability to turn out special orders when absolutely necessary. Incidentally, Lane-Wells Company, maker of the Drillable Bridging Plug, also uses Revere phosphor bronze, strip brass, Herculoy rod and free-cutting brass rod for other parts.

Before you place your next order for copper and copper alloys, get in touch with the nearest Revere office. And remember, if you are having any difficulties in the employment of copper and brass mill products, the Revere Technical Advisory Service will gladly collaborate with you.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

Obituaries

Hugo L. Olson

Hugo L. Olson, president of the Sundstrand Machine Tool Co., Rockford, Ill., and its subsidiary, the American Broach & Machine Co., Ann Arbor, Mich., and active for many years in a score of Rockford industries and business enterprises, died on January 31 at the Swedish American Hospital in Rockford. He was stricken by a heart attack at his home on January 24 after spending the day at the Sundstrand plant.

Mr. Olson was born in Wermland, Sweden, on September 20, 1877, and came to the United States at the age

of fifteen, settling in Rockford, which was his home for fifty-six years. He first started to work in the machine shop of the John Nelson Knitting Co., later being employed by the American Insurance Co.

In 1910, Mr. Olson joined the Rockford Tool Co. and the Rockford Milling Machine Co. as secretary and general manager, and became one of the organizers of the Sundstrand Adding Machine Co. He served this company as secretary and general manager until it was purchased by the Underwood-Elliott-Fisher Co. in 1927. The Rockford Milling Machine Co. and the Rockford Tool Co. were incorporated in 1926 into the Sundstrand Machine Tool Co., of which Mr. Olson became president and general manager. This organization grew into one of Rockford's largest industrial enterprises, and during the war was a key military producer.

Mr. Olson had served on the boards of many industries and businesses, and during the war was a member of the Wartime Advisory Board of the Chicago Ordnance District. He was also a director of the Swedish American Hospital.

George W. Emrick

George W. Emrick, for the last twenty-five years president of the Ettco Tool Co., Inc., Brooklyn, N. Y., and a member of the board of directors for three years, died on January 19 in Florida. Mr. Emrick was born in Sparrow Bush, N. Y., on March 19, 1884. After being employed by the Taft-Peirce Mfg. Co., of Providence, R. I., during the period of World War I, he came to New York to become associated with the E. T. Trotter Co., and started the business now known as the Ettco Tool Co., Inc., to manufacture drill chucks and tapping devices. He is survived by his wife and two sons, who are employed in the business.

Harry G. Leighton

Harry G. Leighton, for many years manager of the Philadelphia office of the Brown & Sharpe Mfg. Co., Providence, R. I., died suddenly at Mt. Airy, Philadelphia, Pa., on January 18. Mr. Leighton had retired in 1946

after more than forty years of service with the company. He was born in Lowell, Mass., on October 19, 1879, and after being educated in the public schools of Lowell went to Brown University, graduating in the class of 1903. In 1905, he entered the employment of the Brown & Sharpe Mfg. Co. in the advertising department, of which he later became head. He was made manager of the Philadelphia office in 1914.

New Books

JIGS AND FIXTURES. By Fred H. Colvin and Lucian L. Hass. 410 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.50.

This book, which covers all aspects of the design and use of jigs and fixtures, is now in its fifth edition. Standard data have been brought up to date and new material has been added on jigs and fixtures for various machining operations. The book shows many different types of jigs and fixtures in actual use. A careful study of the designs shown, as well as of the principles involved, should aid in producing fixtures that are economical both in first cost and in production.

MACHINE DESIGN DRAWING-ROOM PROBLEMS. By C. D. Albert. 519 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

The fourth edition of this work, like its predecessors, gives all the necessary information for drawing-room or laboratory courses in general machine design. The material is based on practical experience, the author having taught machine design at Cornell University for more than forty years. The book includes sixteen comprehensive problems on machine design and ten chapters of reference information covering such subjects as engineering materials, allowable stresses, and screws and screw fastenings, which should be particularly useful to designers.

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Gearing Industry Reports Increase

According to figures compiled by the American Gear Manufacturers Association, Pittsburgh, Pa., the volume of business in the gearing industry, as represented by orders received, increased by 9 1/2 per cent in 1948, compared with 1947. Shipments during 1948 were about 10 per cent greater than in 1947.